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Outline of Topics 217

Advertising Index 67

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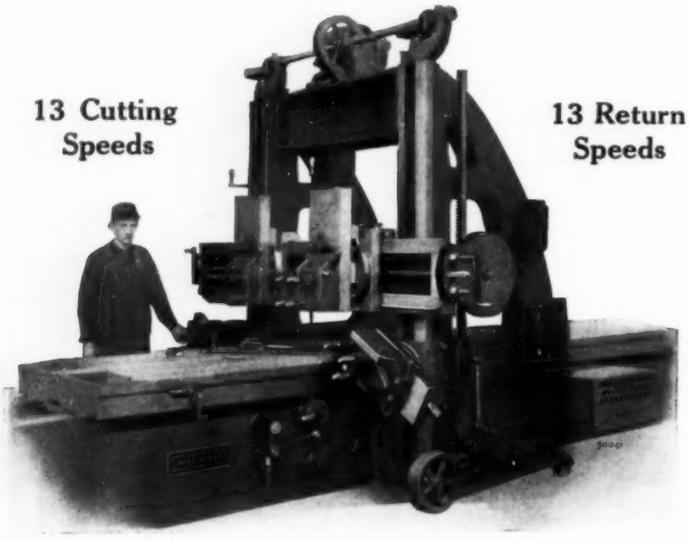

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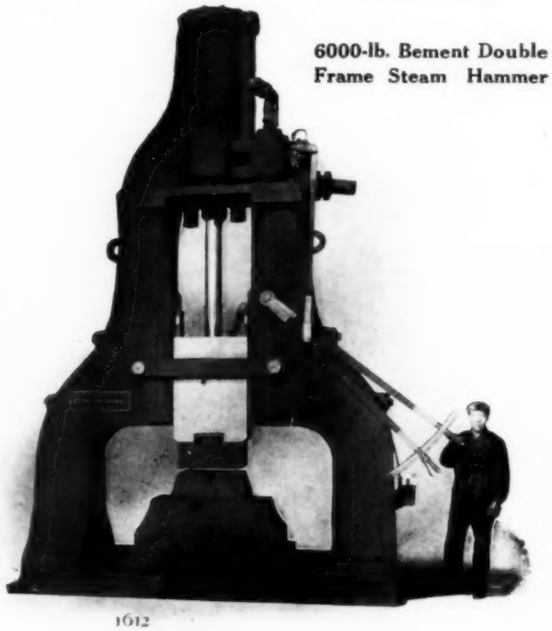

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The Pratt & Whitney Vertical Shaper

By E. A. Dixie

A new machine combining many desirable characteristics of the slotter and horizontal shaper together with novel features which make it particularly useful.

In designing this machine Mr. Hanson's object was to evolve one which would not only be suitable for the usual run of small slotter work, but would also handle the regular line of work usually done on the horizontal shaper, not only in the manufactory but in the tool room where rapidity and precision are important requisites.

Convenient Work Holders

The work-holding accommodations on the vertical shaper have been made very flexible. For instance, when operating internally the method of holding the work invariably permits the completion of the work at one setting. In many instances this same condition also applies to external work, as on planing an irregular shaped punch for a die, the entire periphery may be planed at one setting. The two opposite sides of a piece may be finished on the vertical shaper at one setting, which insures parallelism, and in the event of a piece of work having a hole through which a holding-down bolt can be placed the entire perimeter, whether regular or irregular, can be machined at the one setting. Concave, convex, or irregular surfaces such as hexagons, etc., which are very difficulty to handle on the horizontal shaper are by means of the rotary table handled with the greatest ease on the vertical shaper. A distinct advantage with this tool is that when working to a scribed line on the work, as in die work, the cutting tool, as with the slotter, enters the work on the marked side, instead of leaving the work on the scratched line. As the chip always breaks below the actual cutting surface, the line is broken away before the tool reaches its final finishing depth and there is no line to guide the workman when operating a tool which cuts toward the scratched side.

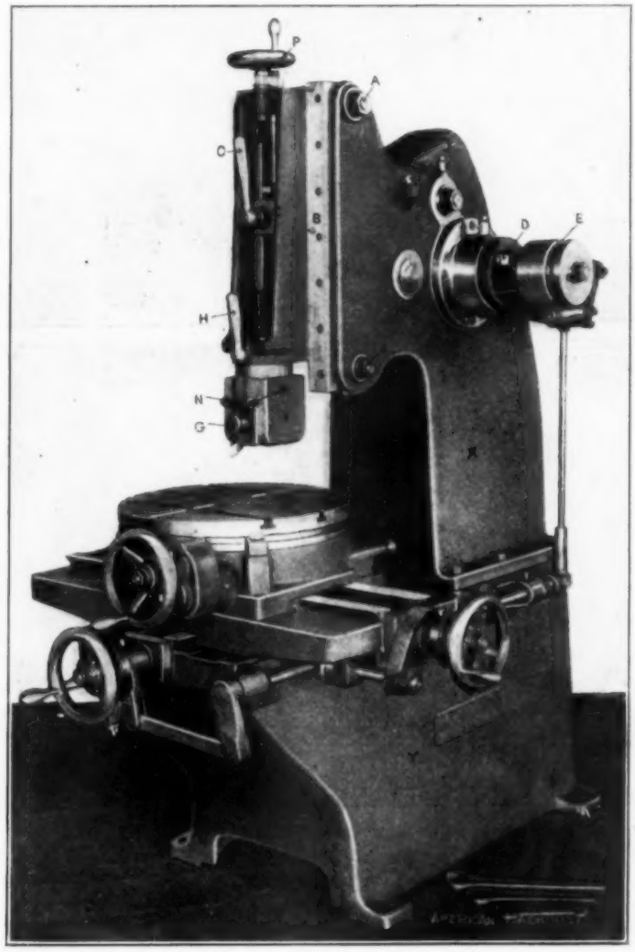


Fig. 1. The Pratt & Whitney Vertical Shaper

General Design

Fig. 1 shows a general view of the machine which has been subjected to a very severe try-out in the P. & W. shops and has been found capable of withstanding severe service without perceptible vibration. The various operating mechanisms have been located so as to be within easy reach of the operator. The pressure of the tool under working conditions forces together all the operating parts, such as knees and slides, which tends to secure continued accuracy.

The Main Frame

The main frame of the machine is cast in two parts, *X* and *Y*, Fig. 1, bolted together. One of these parts *X* carries the seat for the vertical ram slide and the other part *Y*, the table operating slides. This arrangement of the main frame permits the individual castings to be smaller and more easily machined and should the ram and table slides from any cause get out of alinement, either by accident or the gradual releasing of the internal strains in the castings, corrections can more readily be made in a two-piece than in a one-piece frame.

The Ram Slide

The upper part *X* is machined an accurate fit for the entire length of the ram slide *B*. This ram slide *B* is pivoted in the top of *X* on the fitted through bolt *A*, and can be swung at an angle for taper shaping. The binder bolt *I*, at the bottom, passes through both sides of the frame *X* and the ram slide *B*, holding them rigidly together when the ram slide is set at the angle demanded by the work. The lower end of the ram slide is graduated as shown in Figs. 2, 3 and 4, to facilitate the setting of the ram slide for taper work. This is very advantageous on a large variety of work especially in the working out of dies as the desired clearance can readily be obtained.

The Ram

The ram *C*, which is made sufficiently heavy to assure the necessary stability, is mounted in the ram bearing and supported its entire length by suitable gibs. It is driven by a link mechanism similar to that used in the P. & W. horizontal shaper. In order to dispense with the unsightly counterbalance commonly used in slotters, the rear end of the link has been made heavy enough to balance the ram. This gives a very smooth and practically noiseless action. The enlarged portion of the link is covered by a casing *J*, which is cast separate from the upper frame casting, but secured to it by screws. This casing can readily be removed for inspection of the parts and being a separate piece it does not detract from the graceful lines of the frame to which it is attached.

Stroke Adjustment

The length of stroke can be very readily changed in practically the same man-

ner as on the horizontal shaper by means of the hexagonal head *D*, Fig. 1.

The position of the stroke may also be readily changed by releasing the large binder *O* on the front of the ram, and adjusting the ram up or down by means of the screw and handwheel *P* provided for this purpose. The ram has three cutting speeds and a very quick return obtained from a three-step pulley.

The Feed

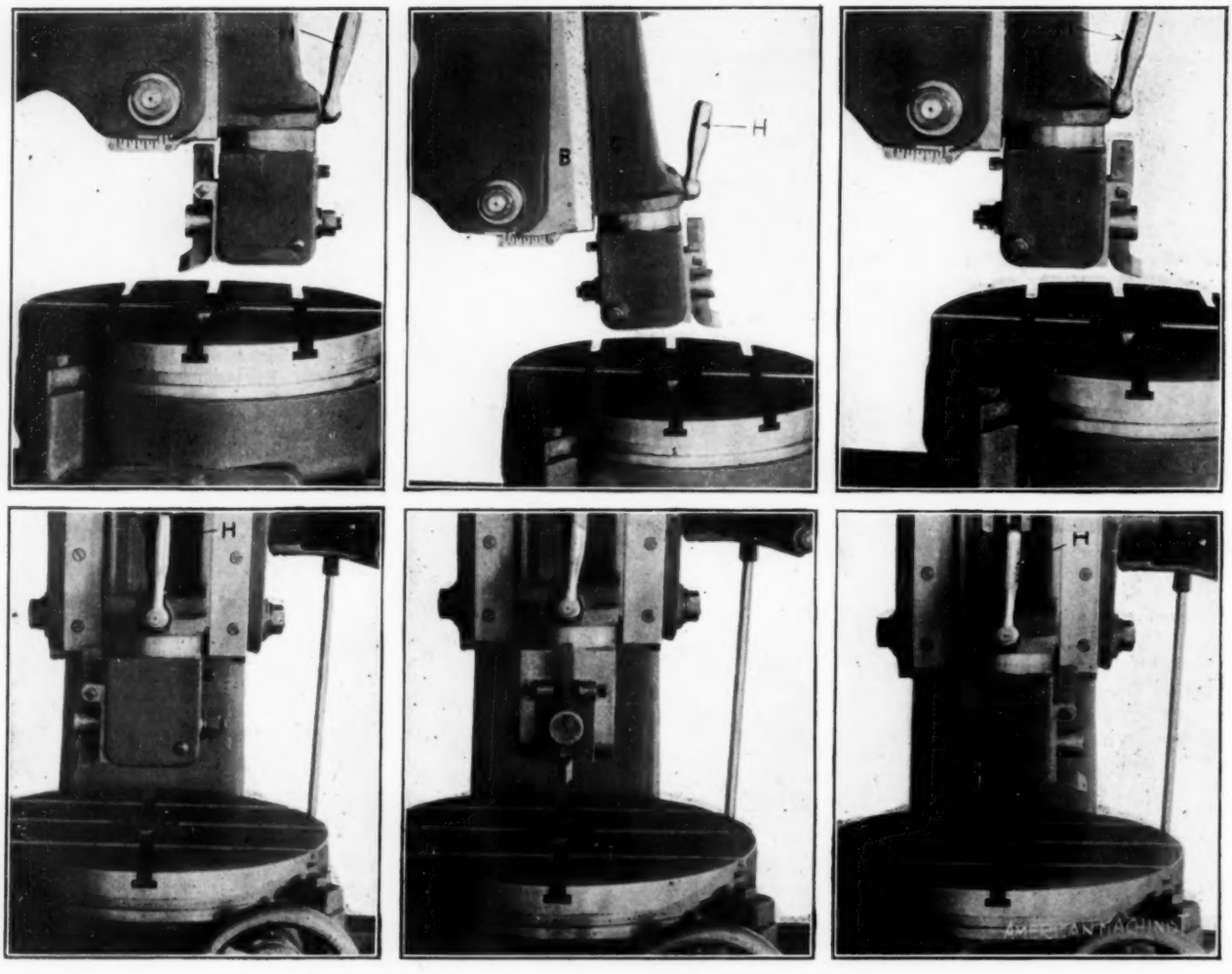
The feed is driven from the cam *E*, Fig 1. The path in this cam is cut so that the feed takes place during a very short interval. With the feed motion of the P. & W. horizontal shaper, the actual feeding of the tool does not occur at any fixed point with relation to the position of the tool in the work, but varies as the stroke of the ram is altered. By the introduction of a simple gear train in the stroke shift mechanism of the vertical shaper, the feed takes place during the time when the tool is clear of the work after the finish of one, and just before the beginning of another stroke.

The Ram Head and Toolpost

A novel feature is the ram head *F* and toolpost *G*. Figs. 1 to 9 show clearly how this head can be swiveled to any angle in a horizontal plane, thereby making it convenient for the operator to adjust the tool in the most advantageous position with relation to the work. The ram head *F* is so designed and mounted in the ram as to be practically integral with it when the binder is in locked position. This binder is of the eccentric type and is locked and released by the lever *H*.

A new style of toolpost *G* is used which is below the cutting edge of the tool, thus in operation it passes the work without interference. The clamping of the toolpost is accomplished with a nut *K*, on the opposite side.

The toolpost is carried in a clapper pivoted at *L*, which gives the same action to the tool as in the horizontal shaper or planer, permitting it to clear the work on the return stroke. The clapper is mounted so that the force of the cut drives it against the head. As cases may occur where exceptionally long tools must be used on internal work, and it would be advantageous to bind the clapper solid with the head, means have therefore been provided whereby the clapper may be clamped stationary, by means of the setscrew *M*. This head permits the use of very short tools, especially on external work where practically no overhang of tool is necessary, so that the tool in operation is dependent upon the ram for its stability, rather than on the tool. Two setscrews *N*, mounted in projection on the clapper hold the tool rigidly sideways. The lower part *V*, Fig. 1, of the frame is planed to receive the saddle.



Figs. 2 to 7. Various Positions of the Ram and Head of the Vertical Shaper

Rotary Table

The machine is provided with a rotary table which is mounted upon the saddle by means of dovetail bearings and taper gib, which may be easily adjusted to compensate for wear. The rotation of the table is conveniently and accurately governed by worm and worm gear, which can be readily disengaged when using the quick indexing mechanism which also forms part of the construction. With it the table may be rotated ½, ⅓, ¼, ⅙

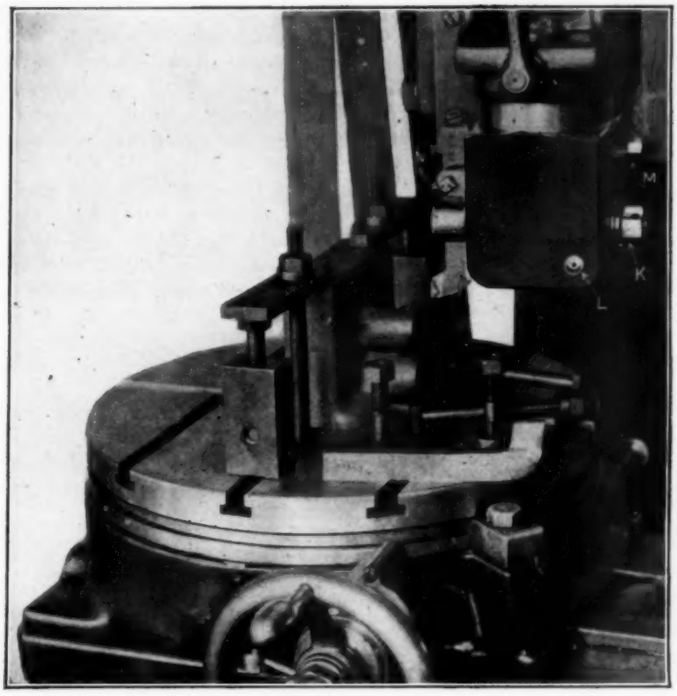


FIG. 8. SHAPING TWO OPPOSITE SIDES OF A CASTING AT ONE SETTING

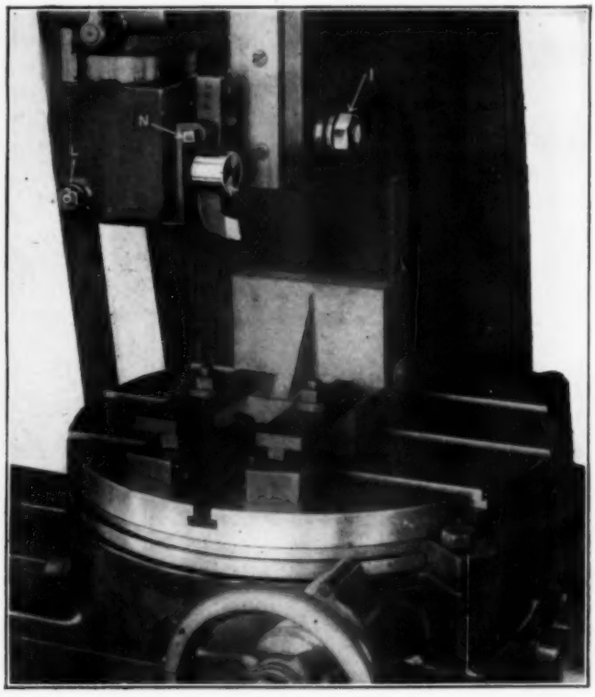


FIG. 9. SHAPING ONE SIDE AND TWO EDGES OF AN ANGLE PLATE AT ONE SETTING

or $\frac{1}{72}$ of a circle. The table is graduated in degrees and the collar on the worm shaft is divided into 60 parts, permitting angular spacing to one minute of arc.

FEED CONTROL

The longitudinal and transverse feed of the table is accurately controlled through precision screws and micrometer dials. The feed ratchets are provided with double pawls so that a feed of half a tooth or 0.002 inch per stroke can be obtained. The maximum feed is 0.025 inch per stroke.

A safety device is provided which prevents breakage should the operator let either of the slides traverse its extreme limit.

TOOLS AND WORK-HOLDING DEVICES

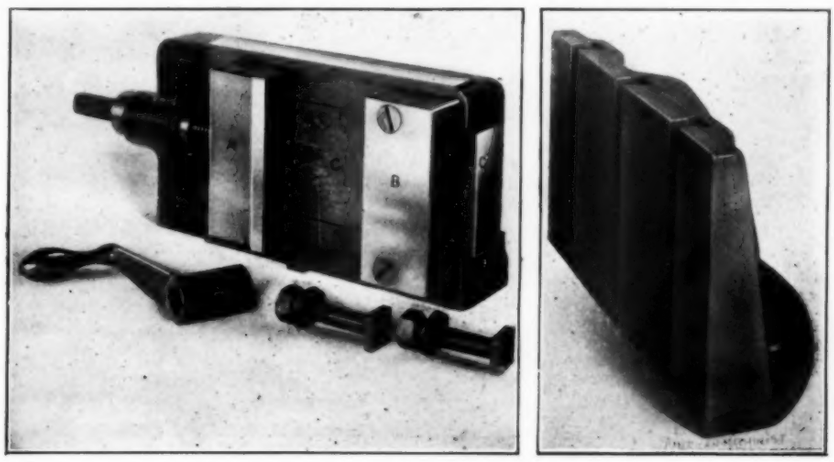
Fig. 10 shows the new vise designed for use on the vertical shaper. The sliding jaw *A* is in one piece with the guiding tongue *C*, while the stationary jaw is secured to the vise body by screws, as shown. The rear part of the body is in the shape of an angle plate and is secured to the table by the two bolts shown in Fig. 10. When this form of sliding jaw is clamped on the work the tendency is to tilt toward the body, thus drawing the work to a seat on the finished surfaces at the sides of the sliding jaw.

Fig. 11 shows the angle plate used on the table.

Fig. 12 shows an exceptionally handy little tool holder and set of tools designed for use in this machine.

The tools are round, square and quasi-triangular at their cutting ends. Their bodies are cylindrical and fit in the hole in the tool holder which is split and provided with a clamping bolt in order to securely bind the tools.

The rear end of the body of the tool abuts against the piece *A* which slides in a slot in the tool holder and is prevented from falling out by a small pin at each end. This sliding piece has a semicircular slot on one edge which can be brought in line with the hole in the tool holder. When in this position the tools can be dropped into the tool holder from the top. The ability to place the tool thus is very convenient on many classes of work.



FIGS. 10 AND 11. THE VISE AND ANGLE PLATE

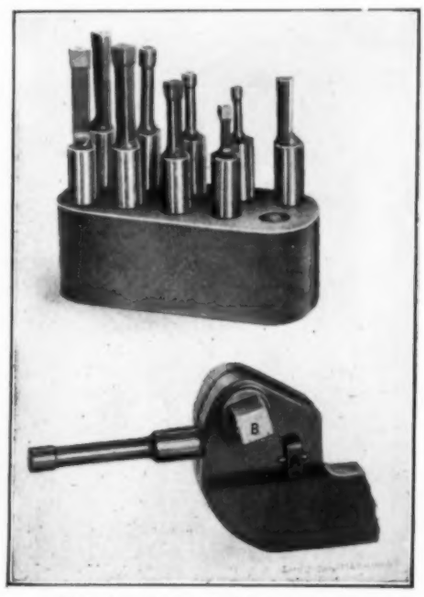


FIG. 12. SPECIAL TOOL HOLDER

General Dimensions

The vertical shaper has a stroke of 6½ inches. Maximum distance from top of the table to end of ram 13½ inches. The rotary table is 20 inches diameter, has a longitudinal travel of 25 inches and cross travel of 14 inches. The vise is 7 inches high. Its jaws are 6 inches wide by 1⅝ deep and open 6 inches. The machine weighs 3750 pounds and occupies floor space 48 by 60 inches. The equipment consists of two work straps with bolsters and T-bolts, one diamond-point tool, one square-point tool, countershaft and set of wrenches.

Tools for Locating Holes in Jigs

By F. A. Stanley

A system of transfer plates used with spotting drills, twist drills and reamers for locating hole centers and finishing holes in jig plates, models, etc.

Several bushings are fitted in each transfer plate and the plates are readily adjusted by size blocks and micrometers to give the positions desired for the different holes in the work.

The tool room and model department of the Sigourney Tool Company, Hartford, Conn., have an interesting outfit of transfer plates, spotting drills, reamers, etc., for use in locating holes in jigs and similar work and for finishing the holes to size. Some of these tools as adapted for use under the driller, and a number of devices for facilitating hole locating and boring on the faceplate of the lathe, are shown in the accompanying engravings.

The System of Plates

Fig. 1 illustrates a number of the transfer plates and from this halftone and the line drawing, Fig. 2, it will be seen that they are composed of narrow steel pieces from ¼ to ⅜ inch thick and of various lengths to suit the conditions under which they will ordinarily be used. There are a large number of these plates with various sizes of bushes in the model-department tool cupboard and, generally speaking, a toolmaker with a piece of work requiring a series of holes to be located with accuracy will find a plate that will answer his purpose. If such a plate with the requisite bushings is not available, it is a fairly simple matter for him to make one, or to make new bushings of the desired size which will enable him to use a transfer plate already in existence.

Center Distances for Bushings

The plates are made up with a number of holes spaced usually on centers of ½ inch, ⅝, ¾, 1 inch, etc.; that is, the center distances selected are those very commonly required in small jig work, and as these center distances are established with accuracy in the transfer plate itself, they may be reproduced accurately in any piece of work requiring the same spacing between holes.

It is more frequently the case that the transfer plates are used for putting holes in jigs and in other tools in which different center distances are required than are found in the plate. In such instances one hole is put through the work in the proper position by means of one of the holes in the transfer plate and the latter is then readjusted by micrometer, size blocks, or some equally efficient method, and the second hole put through.

How the Tools Are Used

The transfer plate is used under the driller spindle. After it has been properly located on the jig plate or other work requiring holes to be located and put through, it is secured by clamps to the work and a spotting drill is run down through the bushing and into the work just far enough to form a good starting center for a reamer-size drill which is then run clear through the piece. This drill leaves only a few thousandths of an inch for removal with the reamer which brings the hole exactly to size.

The starting drill for small holes is a regular twist drill with the body ground cylindrical so as to fit the bushing and not wear it unnecessarily. The reamer drill is used in its regular condition as it does not touch the bushing, but the reamer itself is ground to a cylindrical form to fit the bush, after which its

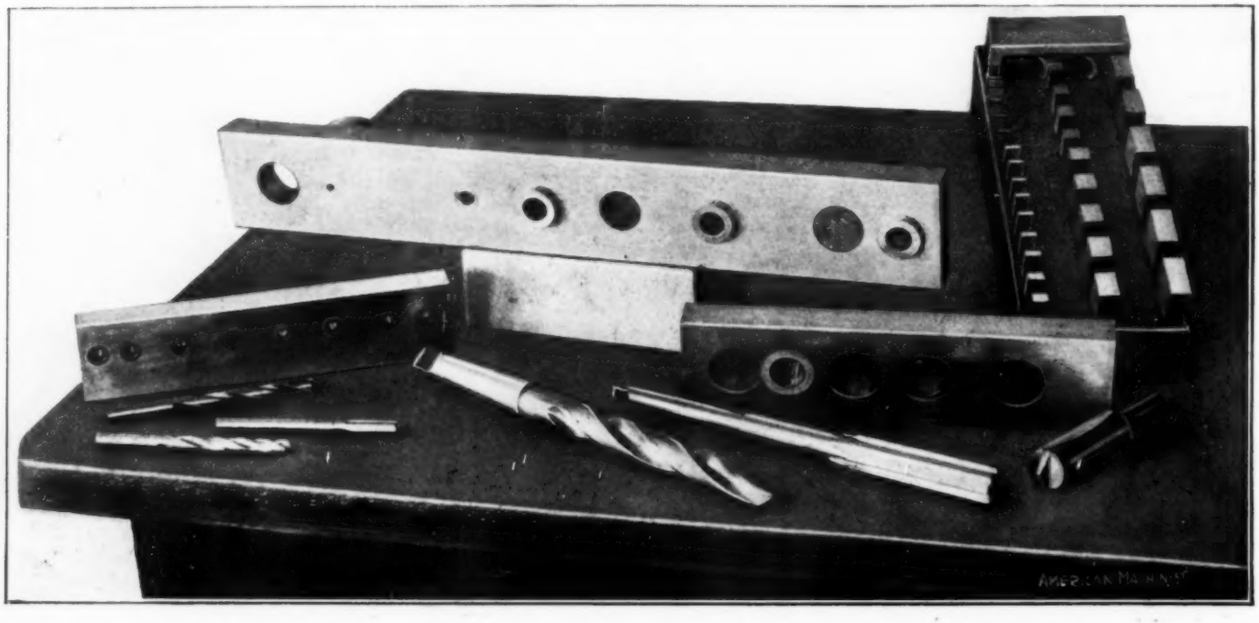


Fig. 1. Transfer Plates and Other Tools for Locating and Boring Holes in the Driller

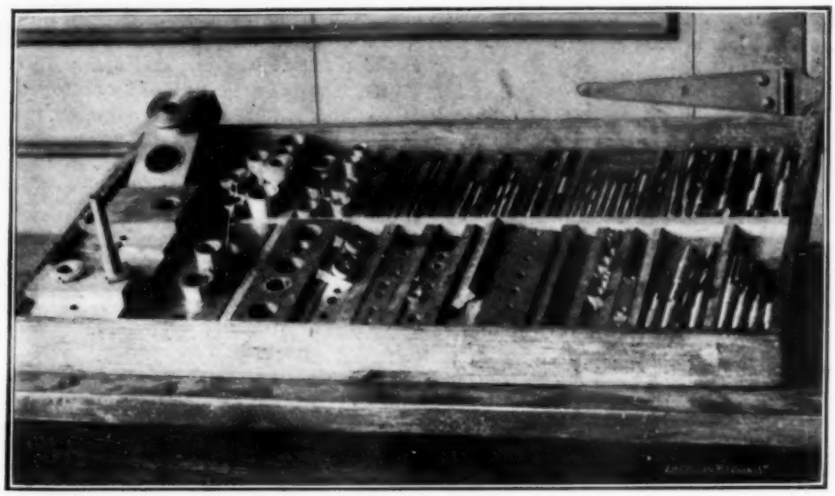


FIG. 3. A TRAY FROM THE TOOL CUPBOARD

teeth are relieved very slightly with the oilstone, to prevent rubbing in the hole (which is finished principally by the end of the reamer), a slight amount of back clearance also being given the lands during the stoning process.

PROCEDURE WITH LARGE HOLES

For larger holes, a starting drill is used with a plain cylindrical body and a flatted putting point, as represented in Fig. 1. A number of these drills will be seen in Fig. 3, which shows one of the drawers from the tool cupboard, with a variety of transfer plates, bushings, drills and reamers.

Shelf 1	Wood clamps
Shelf 2	Laps
Shelf 3	Plug gages
Shelf 4	Gages
Shelf 5	Drills
Shelf 6	Drills
Shelf 7	Reamers
Shelf 8	Arbors
Shelf 9	Screw tools
Shelf 10	Discarded plug, shells and rings.
Shelf 11	Arbors
Shelf 12	Scrap stock

FIG. 5. INDEX FOR CUPBOARD

With some of the larger holes, instead of following the starting drill with a reamer-size drill, a smaller drill is put through and a counterbore then employed to open the hole to within a few thousandths of finished size, leaving just enough for accurate reaming as in the case of the small holes.

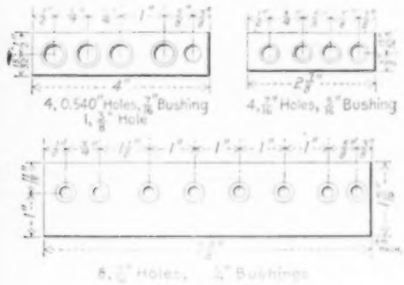


FIG. 2. TRANSFER PLATES

SIZE BLOCK AND MICROMETER SETTINGS

A set of size blocks for use in setting the transfer plates is seen in Fig. 1. Where a number of holes are required in a row, the plate can be slid along a parallel or a ledge on the work, and with

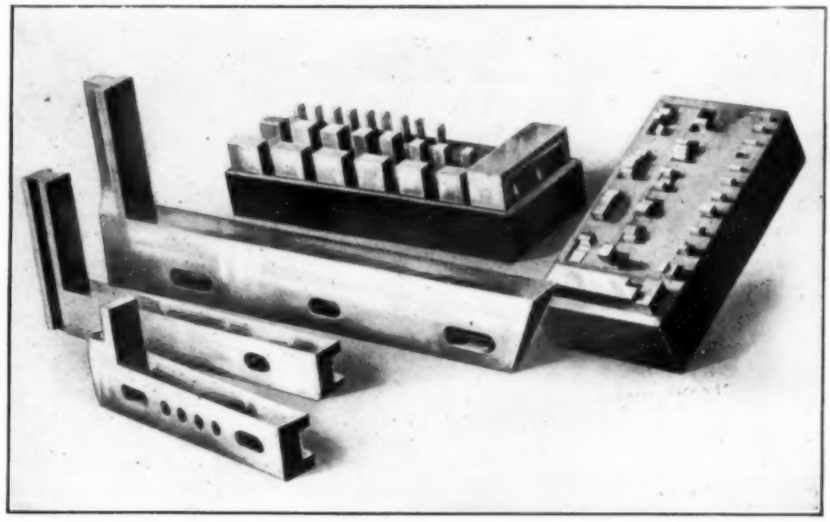


FIG. 4. TOOLS FOR FACEPLATE OPERATIONS

Cupboard—D—Shelf—4.

GAGES

THE SIGOURNEY TOOL CO., HARTFORD, CONN.

FLAT LENGTH GAGES C.I.		CYLINDRICAL LENGTH GAGES		DISK GAGES		ADJ. BLOCK GAGES		3 FACEPLATE ANGLES
Size	No.	Size	No.	Size	No.	Size	No.	2 Nurled Handles for
12x2	4	6	1	2.623	1		2	Disk blocks
6x2	2	5	1	2.625	1		2	Block of small figures
5x1¾	2	4	1	2.1875	1		2	
4x1¾	2	3 | not	1	2.1855	1	1½	2	
3x1½	2	2 | fin'hed	1	1.750	1			
2x1¼	2			1.748	1			

BLOCK OF FLAT GAGES								BLOCK OF FLAT GAGES, ODD SIZES									
No.	Size	No.	Size	No.	Size	No.	Size	No.	Size	No.	Size	No.	Size	No.	Size	No.	Size
2		1		1		1		1	0.067	1	0.116	1	0.1375	1	0.1535	1	0.187
2	0.043	1		1		1		1	0.0892	1	0.1177	2	0.138	1	0.1543	1	0.203
1		1		1		1		1	0.102	2	0.120	1	0.1387	2	0.158	1	0.2039
1		1		1		1	1	1	0.104	2	0.1245	1	0.141	2	0.1665	1	0.297
1		1		1		1	0.213	2	0.110	1	0.1294	1	0.1445	1	0.1725	1	0.740
1		1		1		2	0.9555	1	0.1132	1	0.1325	1	0.1447	3	0.1775	2	1.110x2
1		1		1		in	tray	2	0.115	1	0.135	2	0.1531	1	0.1825		

FIG. 6. TOOL CUPBOARD INDEX

the size blocks or with a micrometer, the center distances can be readily obtained. The blocks may be used between a fixed stop and the end of the plate, or between one edge of the plate and a parallel or straight-edge along the edge of the work. Micrometer measurements may be made over the edges of the plate and some convenient surface on the work; or a plug can be placed in any bushing hole in the plate to form a measuring point for the micrometer.

EQUIPMENT FOR FACEPLATE OPERATIONS

The tools in Fig. 4 form part of the outfit for setting work which is to be bored on the faceplate of the lathe. The members in the form of a try square are intended for bolting to the faceplate and they provide two square surfaces along which the work may be slid in the different settings, or from which it may be adjusted by means of size blocks or micrometer for accurate positions for the hole centers.

INDEX FOR TOOL CUPBOARDS

The contents of the different sections of each of the tool closets are tabulated in a blueprint book made up of 6x9 pages. The first page, Fig. 5, shows the kind of tools on each shelf of the cupboard, and a detailed list of the tools on each shelf is given on the other pages of the book. Fig. 6 shows, for example, the sheet on which is recorded the different sizes of gages kept on Shelf 4 of Cupboard D. Many of the tools indexed in this way are of special sizes and the book is a great convenience in enabling the toolmakers to determine at once whether a certain size block, or some other special tool, can be found in the cupboard.

Milling with an Electric Hoist

EDITORIAL CORRESPONDENCE

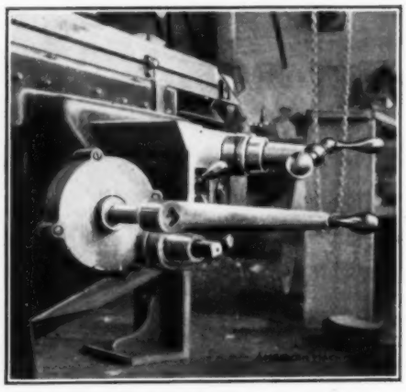
One of the interesting things I found in the Dillon-Box Machinery Company, in Denver, Colo., was the speeding-up device which they had put on the vertical lifting screw of the knee of the LeBlond miller shown in the accompanying illustration. This was done on account of a special job in which the knee was used to a considerable extent, and it was found that the regular gearing was too slow for this special job. So the 4 to 1 speeding-up device was made, as can be seen.

This consists of a neat and substantial bronze casing which incloses the multiplying gears, and the projecting shaft with the square end allows the same handle to be used in either position, according to the work to be done. This has been found very convenient, not only on the original work, but in many other cases, and the ease with which either one or the other may be used, means that many minutes are saved in the course of a year.

MILLING WITH AN ELECTRIC HOIST

As an indication of the great variety of work which comes into a shop building mining machinery, Mr. Box told me of an extremely interesting job which came up in connection with a large hoisting drum. In addition to the regular work on the drum, such as boring the hubs for the shaft, there were two faces to be finished at an angle with the axis, and no apparent way of handling the work by any of the usual methods.

But, as is usually the case in small shops, there always seems to be sufficient ingenuity on tap with the result that one of their electrically driven hoists was converted into a miller for this purpose.



MILLING WITH AN ELECTRIC HOIST

An extra long drum shaft was put in, and on the end of this a sweep milling cutter was fastened, and the whole hoist moved into the correct position to the work, and fastened so that the finished surface would be at the correct angle. By this ingenious method the work was accurately done in very satisfactory time.

A SIMPLE SYSTEM OF KEEPING DATA

This company has a very interesting method of keeping track of the work done so that all information concerning it can be instantly available.

In the case of the speeding-up attachment for the knee of the miller, as has been shown, a catalog of this particular make of machine, the sketches for the attachment, the requisition for the material and its cost, and the time slips showing exactly how much the work on the device costs, are all filed together in a single envelop, which is indexed in a card file under as many headings as may be thought necessary, one or two being sufficient in this particular case.

In the case of work done for regular customers, all correspondence, estimates, sketches or other information in regard to the work are collected together; so is the cost of all material and labor, as many blueprints as may be necessary to give a complete story of the job, and all are filed in one or more envelops so that all the required information can be found at any time without hunting through various files.

This makes a very simple system, and one which seems to have a number of excellent points, as it can be used equally well by either a large or small company or on any kind of work. F. H. C.

Another High Speed Record

BY F. P. TERRENCE

Some time ago a new twist drill was invented. It has been consistently brought before the public, through the advertising columns of this journal. To look at it even on paper suggests gripping and piercing abilities. I was soon attracted, and after a trial, decided upon its general use in the shop.

A part of my duties include the supplying, on requisition, of small tools to the workshops connected with our branch offices in various parts of the world. In due course I despatched some of these drills to our Calcutta branch, and I was somewhat surprised to receive, almost by return mail, a second requisition for twist drills, stipulating, "on no account send the new style." I could not account for this, but as this manager was expected home shortly on a holiday, I decided to delay the necessary investigations to remove the reflections upon my purchasing ability.

On his arrival I lost no time in putting the questions: "What was wrong with the drills?" and, "what sort of a test did you give them?"

"There was nothing wrong with them," he replied, "most of them mysteriously disappeared on arrival, the remainder following in two or three days. The only test I got was in the Bazaar one evening, when I saw one of them dangling from the waste of a native, and when he saw me, that drill went at a speed far beyond the inventor's wildest dreams. I am not questioning your judgment in the least, but look here, Terry, if you are anxious to present elegant stilettos to every blessed nigger around Calcutta, you might as well include the sheath belts."

Where the sand available for molding brass is rather open in its nature it may be necessary to partially close it by using some clay in the mixture and then skin-drying the mold. This latter process is accomplished by hanging a sheet-iron basket over the face of the mold, filling it with charcoal, and allowing the charcoal to burn, or the mold may be set up with its face a few inches from a cast-iron stove, brought to a good temperature, or it may be dried next to an ordinary coke-fired salamander. This is simply a basket made of iron rods in which a coke fire is maintained.

Three Kinks in a Mining Machine Shop

By Fred H. Colvin

Holding work on a boring mill so as to get at all faces possible at one setting.
Handling large lathe work on a horizontal borer.
A method of rolling conical sheets.

There was, unfortunately, very little new work going through at the time of my visit to the Denver Engineering Works, Denver, Colo., so that it was not possible to see many of their interesting shop methods in actual operation.

In Fig. 1, however, is seen a method which they use to a considerable extent in boring-mill work, so as to be able to machine as much of the surface of the work as possible at one setting. This method consists in having special angle pieces bolted to the faceplate of the boring mill

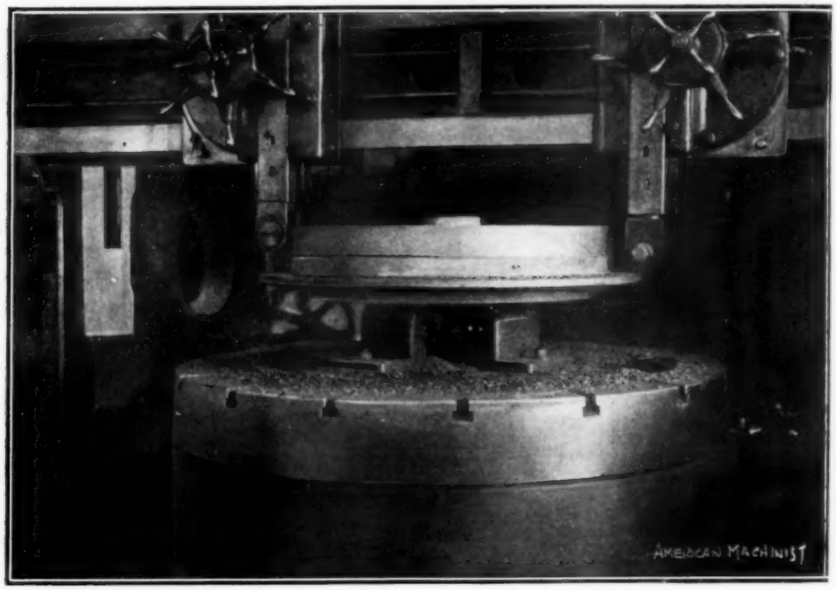


FIG. 1. HOLDING BORING-MILL WORK ON BRACKETS

for both holding and driving the work at such a distance from the boring-mill table as to allow the tool heads to work underneath without difficulty. In the illustration shown, the entire outer surface of the wheel can be turned and the hub bored at a single setting.

They also have a method of driving pulleys in such a way as to avoid distortion by taking all of the driving strain on one or two spokes so as to avoid springing the casting out of shape by an undue straining of all of the points which are clamped to the driving blocks.

LATHE WORK IN A HORIZONTAL BORER

Fig. 2 shows an interesting lathe job which is being done on a Newton horizontal boring machine. This was too large to swing in any lathe in the shop, so an outboard bearing or tailstock was arranged as shown, being fastened to the table and supporting the outer end of the work. Jack screws are used between the under side of the supporting tail block and the floor to avoid sag or spring due to the overhang.

The work to be done is the facing and turning of the ends of the spider arms, one of which is just passing the tool, and which makes a mean proposition to handle on account of the blow caused by the work striking the tool. The work is driven by the special chuck which is screwed to the end of the boring spindle, and a tool block from a nearby lathe was bolted to the upper face of the table shown, which was taken from a radial driller which happened to be handy. This makes a fairly convenient improvised lathe and a number of large jobs which could not have been handled otherwise, have been done in this way. The particular job shown is what is known as a Hardinge conical mill and is 8 feet in diameter. It is interesting to note that this method has proved so satisfactory that the machine has been moved to a different location in the shop and an extension put on the bed so as to allow the turning of the trunnions of long tube mills after they have been riveted together. The temporary outboard bearing shown has been replaced by a new and substantial fixture.

ROLLING CONICAL SHELLS

They also make a number of conical shells which resemble this one, but which run down nearer to a point, and there is sometimes difficulty in rolling these so as to preserve the correct curvature all the way down.

The foreman of this department has devised a way of fastening a piece of plate to the small end, in such a way that it will hold this end of the sheet almost stationary between the rolls while the larger or outer end of the sheet is being passed between them and receiving its curve. In this way he finds it possible to produce almost the true cone by the use of straight rollers, which is not often accomplished. Needless to say, this requires considerably more power than in rolling

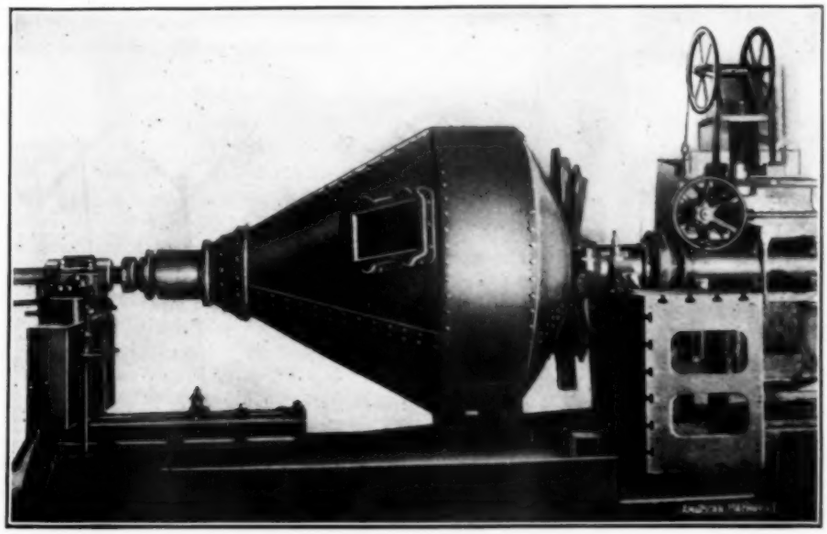


FIG. 2. LARGE LATHE WORK ON A HORIZONTAL BORER

a straight piece in the regular way, owing to the fact that there is considerable slipping all along the line between the rolls and the plate which is being curved.

We are indebted to both Mr. Searing and Mr. Lockwood for their assistance in securing both illustrations and the information in regard to their work.

Turning on the Horizontal Borer

By T. S. Penney

This flywheel was made of four sections by the Frank Kneeland Machine Company, department of the United Engineering and Foundry Company, of Pittsburg. The rim, a section of which is shown in Fig. 1 at *A*, is a steel casting 13 feet 10½ inches outside diameter and 11 feet 6 inches inside diameter. Two rolled steel plates 1½ inches thick by 11 feet 3½ inches diameter form the web. The spider shown at *B*, Fig. 1, is also a steel casting with eight arms, 8 inches by 6 inches. The hub is 2 feet 6 inches diameter. The different parts were machined and then riveted and bolted together, with sixty 1½x12-inch countersunk turned rivets and sixteen 2-x13½-

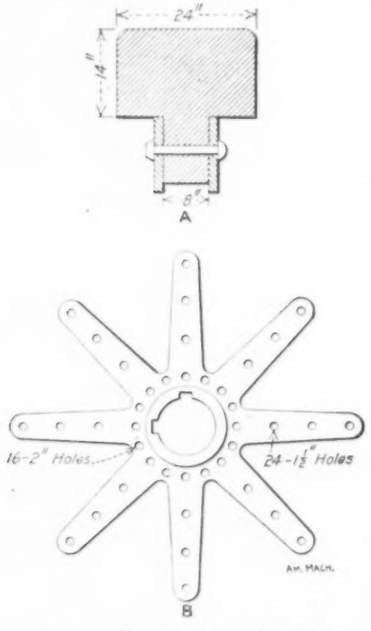


Fig. 1. The Rim and Spider

inch turned bolts. The face of the wheel is 24 inches.

Fig. 2 shows it in position on the horizontal borer, being trued up after riveting together. The mill was used as a drive only. The toolpost was clamped to table. As it was swung on a true mandrel we were certain of its running absolutely true. The wheel was built for an 18-foot merchant mill for the Illinois Steel Company.

It was shipped in a pocket car taking almost the maximum shipping hight, weight complete about 750,000 pounds, speed 150 revolutions per minute.

To swing the wheel in the borer a mandrel was fitted to it with a gear on the end. This gear was in mesh with

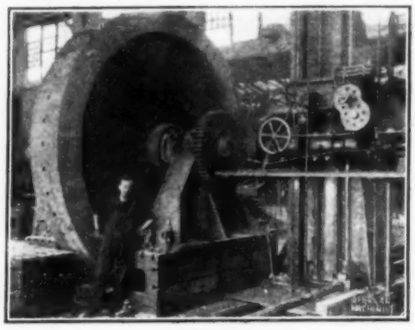


Fig. 2. The Job in the Borer

a pinion mounted on the end of the spindle. This arrangement provided the drive.

The Aeronautical Society

By Carlos de Zafra*

Because of the big prizes and large salaries offered, aviation seems to be the one means open to those who have been waiting all their lives for an opportunity to make their fortunes in a few minutes.

And so advantage has been taken by the unscrupulous of these opportunities for money making, not that they themselves would seek the prize—no, that is too dangerous—but by broadly advertising that greater moneys are to be made in aviation than in any other way, and offering for sale all manner of things to "b u i l d-your-own-machine-in-your-own-yard"—stove bolts, bent tin and twisted wires, etc., worked into shapes called "fittings," made by men without any knowledge of the extent or kind of forces they are to withstand, to say nothing of the crudeness of their manufacture or the unmechanical manner in which employed.

Tensile stresses acting along compression members and transverse stresses acting where longitudinal stresses should be or conversely, and a fitting suitable only to take up a longitudinal stress being employed in such way as to take up that stress in a transverse manner, are things not uncommon. Only a few days ago I noticed at a glance several examples of the latter case while examining a new machine, which gave evidence of the very great care in its workmanship, it having been built by a recognized aëronautical firm. The breaking of any one of these fittings—which must result with the application of but a fraction of the stress capable of being resisted by the fitting properly built into the machine—would result in the loss of the control of the machine, and even under possible conditions, the total collapse of a wing.

Numerous other violations of "common-sense construction" if nothing more, are continually resulting, due to the numerous amateurs and nonmechanics in the field, and while these are too numerous to mention here, a very serious, broad and well founded endeavor is being made by the first organization in the world formed for the practical pursuit of the problem of mechanical flight by man, the Aëronautical Society, to place aëronautical construction on a sound, scientific and thoroughly practical basis.

The Aëronautical Society, founded and incorporated in June, 1908, has devoted its energies from the beginning to the scientific rather than to the commercial or sporting problems, because it was first to recognize not only the lack of available data for almost every phase of the new art but the absolute necessity for it, which would make itself the more apparent as the fervor for prize money died away and the era of development along lines of practical and commercial utility should eventually dominate. To this end it was the first organization in the world to have flying grounds for its members, with work shops, sheds and tools, and the use of motors with which to try out their machines. It was not only the first in the world, but is still today the only similar body to provide such assistance. It was the first aviation society in the world to give a public educational exhibition of flying machines.

It is hoped by its members that the Aëronautical Society will bear the same relation to aviation in this country that the American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Institute of Electrical Engineers, the Society of Naval Architects and Marine Engineers, etc., bear to their respective professions. To this end a Technical Board was created, composed of most capable scientists and engineers, and subdivided into committees, each assigned to a particular duty and each composed of such members from the Technical Board as were best qualified to pursue that particular work.

*A director of the society and chairman of the committee on construction.

The core-room proportion in the case of side floorwork in a gray-iron foundry is generally much less because many of the molds require no cores and as a rule the floors are cleaned each day, so that the entire molding area is continually active and varies from 10 to 15 per cent. of the area of the side floor. In the case of loam work frequently only a very small number of cores are used which are not made on the loam floors, but of course, when loam work is being carried on drying ovens are necessary and the entire proposition partakes of the nature of a core problem.

Stock System of a Modern Factory

By W. R. Emig

Method of keeping track of stock at all points in its routing through a large factory.

A model stock office and stock-storage room.

The stock system used by the Toledo Computing Scale Company is the same as that in a bank. Nothing enters the stock room unless it is accompanied by a forwarding slip, such as shown in Fig. 1, and nothing is given out of the stock room without a check, such as shown in Fig. 2, which must bear the signature of someone in authority.

We all realize that there is no system which is perfect. The books in a bank do not at all times balance correctly, and so it is with the stock system, for no matter what kind it may be, there will always be some shortage as well as some surplus.

The starting point of our system is the folder, on which all records are kept and from where all orders are issued through the factory on regular order slips like Fig. 3, stating the number of parts to be made and the amount of stock to be delivered to make them. There are four different kinds of folders, known as raw folder, semi-folder, finished folder and supply folder. In connection with these folders, we also keep what is known as the clearance sheet, upon which entries are made each day taken from the forwarding slips, showing the location of the different parts in the factory. For instance, the original copy of a forwarding slip marked from the machine department to the inspection department, stating the number of pieces, the name, etc., is sent to the stock office where all records are entered upon folders. At this point all stock is governed, orders are sent through the factory and to the foundries, and made up for all stock bought outside. Each order started from this department has a due date, stating the day on which it should be in stock, and the various departments are governed accordingly. In case stock is not in the stock room on the due date, a stock chaser is sent out to investigate. When the stock is needed badly a sent-ahead card is used, which is known by its red color, which signifies that the stock has been sent ahead, is past due date, and must have preference over other stock.

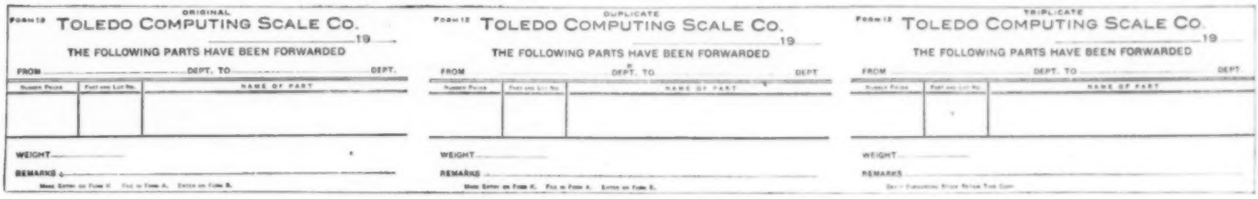


FIG. 1. FORWARDING SLIPS, WITHOUT WHICH PROPERLY FILLED OUT, NOTHING IS PLACED IN THE STOCK ROOM

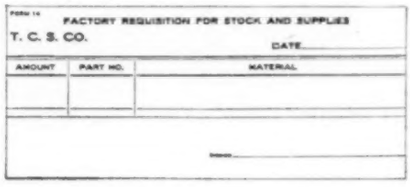


FIG. 2. THE "CHECK" NECESSARY FOR THE WITHDRAWAL OF MATERIAL

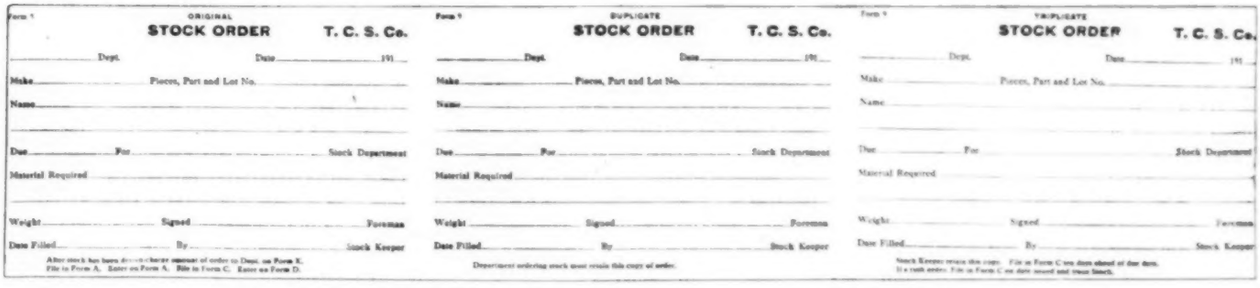


FIG. 3. ORDER SLIPS WHICH INSURE THE PROPER ROUTING OF ALL MATERIAL

ROUTING THE PARTS

To further illustrate the system, we will take for example the folder, part of the outside of which is shown at *A*, Fig. 4, upon which will be noticed the part 243, base horn, in the raw, order 5643, being placed with the foundry on February 25, with the due date of March 1 and the amount of the order 1000. Also the date received, March 2, and the amount 1021, on which date same was entered on the inside of the folder, as at *B*, showing the different amounts of orders, which were placed and sent through the factory; also showing the deductions and the invoice of same on March 28. After this part has been machined up and forwarded to stock again, it is entered on the semi-folder, as illustrated at *C* and *D*, showing the amounts and dates on which they were received. This particular part, after being entered upon the finished folder, is again sent out on regular factory orders in different amounts through the enameling department, as recorded at *E* and *F*, to be put in whatever finish is required. The entries made upon these folders are taken from the forwarding slips, and the deductions are made from the requisitions and orders, so it will be noted that the only possible chance of error we have would be due to careless figuring or loss of either forwarding slip, order, or requisition. The benefit obtained from this system is that we continually have a correct invoice, and can at any time give out information as to the amount of stock we have on hand, the amount ordered outside, and the amount traveling through the factory; also the location of the different parts in the factory.

THE FOLDERS USED

Parts of a folder used for supplies are shown at *G* and *H*, which need no explanation.

A view of the stock office showing the folder files is given in Fig. 5, and Fig. 6

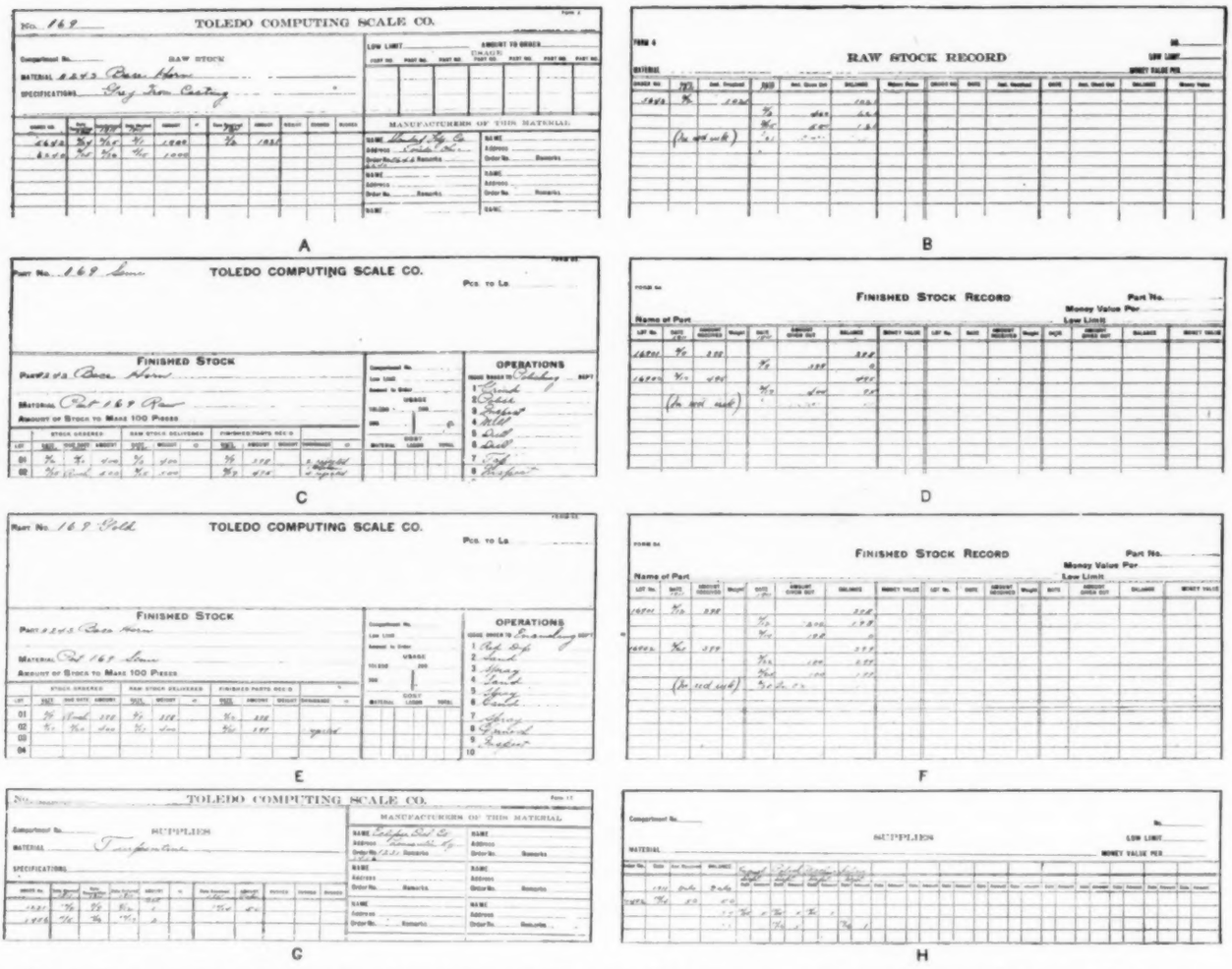


FIG. 4. PARTS OF BOTH OUTSIDE AND INSIDE FOLDERS USED FOR RAW, SEMI-FINISHED AND FINISHED STOCK AND SUPPLIES

shows the way stock is stored. It will be noted that we have portable cabinets of standard size, made to accommodate the different kinds of stock, the advantage of which is that at any time we wish to move or rearrange the stock room, it can be done very easily without destroying the bins or mixing the stock.

FIG. 5. VIEW OF STOCK OFFICE, SHOWING DRAWERS FOR FOLDERS

Each drawer or bin is sealed to a certain weight with lead weights, to facilitate the computing of the number of parts contained in it when invoicing, the drawer and contents being placed on the scales, the known weight of the drawer deducted, and the number of parts calculated from the remainder.

In delivering stock to our assemblers, we have a loading tray, shown at *A*, which is designed to hold enough parts to build four scales. By having this loading tray, we have an absolute check on the assemblers, as only enough stock is delivered to complete the number of scales ordered. Should one piece be spoiled by the assembler it must be returned to the stock department with a requisition marked "replace" and signed by the foreman of that department.

Our stock is handled on the same plan as the records are kept on the folders, and we have a finished, semi-finished and raw-stock room. Nothing enters any of these stock rooms unless it is accompanied by a forwarding slip with the O. K. of the inspector in the inspection department, which certifies that the count is correct, that the finish is as ordered,

and that the same is up to the gages and the blueprints.

Fig. 7 shows the manner in which our gages are handled in cabinet form, the same as the stock, and upon a truck. The object of having this cabinet upon a truck is that each night all gages can be moved to the vault, which is absolutely fireproof.

With the gaged and inspected stock is sent a pay voucher, as illustrated, Fig. 8, stating the number of pieces made; whether day work or piece work, a space being left vacant for the inspector to mark the amount accepted and the workman is paid accordingly.

I have tried to cover all the advantages of this system and will state that I do not believe there is any system which can be operated in a factory where so many different parts are used that could give a better check upon the stock than the above. In my experience with this system I find it to be very simple for both the employees and the foremen of the different departments.

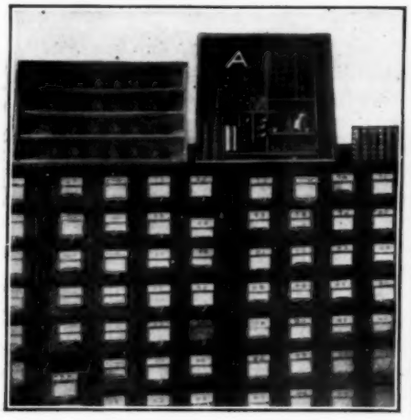


FIG. 6. STOCK-STORAGE CABINETS

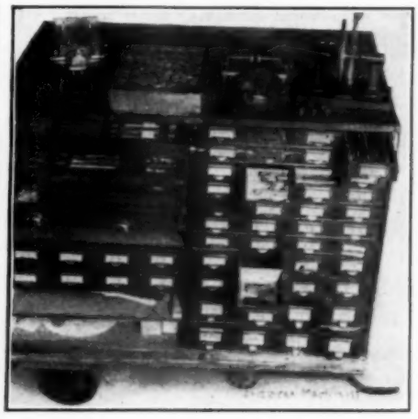


FIG. 7. CABINET FOR INSPECTION GAGES

Form 60 ORIGINAL

WORKMAN'S TIME VOUCHER Charge No.....

Part.....

Workman..... Check No.....

Lot No..... Date started ..... 19.... Date finished ..... 19.....

	7.00	28	9.48		12.48	78	3.36		4.18		4.18		4.18		4.18
2	7.12	30	10.00	52	1.00	80	3.48	3	5.06	3	5.06	3	5.06	3	5.06
4	7.24	32	10.12	54	1.12	82	4.00	6	5.24	6	5.24	6	5.24	6	5.24
6	7.36	34	10.24	56	1.24	84	4.12	9	5.42	9	5.42	9	5.42	9	5.42
8	7.48	36	10.36	58	1.36	86	4.24	12	6.00	12	6.00	12	6.00	12	6.00
10	8.00	38	10.48	60	1.48	88	4.36	15	6.18	15	6.18	15	6.18	15	6.18
12	8.12	40	11.00	62	2.00	90	4.48	18	6.36	18	6.36	18	6.36	18	6.36
14	8.24	42	11.12	64	2.12			21	6.54	21	6.54	21	6.54	21	6.54
16	8.36	44	11.24	66	2.24			24	7.12	24	7.12	24	7.12	24	7.12
18	8.48	46	11.36	68	2.36			27	7.30	27	7.30	27	7.30	27	7.30
20	9.00	48	11.48	70	2.48			30	7.48	30	7.48	30	7.48	30	7.48
22	9.12	50	12.00	72	3.00			33	8.06	33	8.06	33	8.06	33	8.06
24	9.24			74	3.12			36	8.24	36	8.24	36	8.24	36	8.24
26	9.36			76	3.24			39	8.42	39	8.42	39	8.42	39	8.42

D. W.	Operation	No. Pieces	Total Time	Pieces Accepted	Rate	Earnings
P. W.						

Signed..... Foreman ..... Inspector

FIG. 8. TIME VOUCHER ISSUED IN TRIPLICATE FORM

An All-around Man

Our old friend, Sterling Elliott, recently advertised for a handy man and sends us one reply which records one of the widest experiences we have ever known. We understand that Mr. Elliott considered such an experience too valuable to waste in the position he had in mind. The reply follows:

"In reference to your adv for Handy Man.

I want to state a few things with which I have been more or less familiar in past twenty-four years and might possibly answer your requirements.

Borned a farmer son.

Had a common school and acedemic education.

Taught school.

Worked in mines as laborer, asst supt in sorting cleaning, weighing, washing and overseeing of machinery.

Running stationary engines (hoisting Pit Engines) later rock cutting, laying rails, ec. (R. R. work.)

Hotel store keeper and other work.

Entered wholesale woolen and cotton house to do chores, in two weeks entry clerk, in four weeks asst. in Bookkeeping, in nine weeks in charge of receiving, filling orders and shipping.

Two years after in carpet house, in six month in retail dry goods selling.

Six years in another dry goods, assistant to manager. Two years later salesman in another dry goods, then asst buyer in High Class novelties.

10 years later in business for myself.

Four years later on the rocks, returned to sell gents furnishings, then to novelties.

Have schemed out methods and improvement in various lines. Have thought out ideas systimattically of articles since patented (not by me) and methods in use in dry goods houses.

I can do ordinary carpenter work and painting. Can shoe a horse or butcher an ox ready for market.

Fix clocks sewing machines, door locks ec not too complicated.

I can cut & make shoes, can make a suit of clothes for man or woman.

Have done hair cutting with machine or scissors.

I believe I can do anything with the necessary tools in an imergency.

I am an athority on smallpox & all other decesses & can furnish all kinds of references as to character honesty ec.

Should you want to see me, write at once.

To ———— M. D.

P. S. I am married 43 years strong healthy and confident of my abilities."

In making brass castings, the material having the highest melting point should be introduced first and melted. If scrap is being melted, the coarsest scrap should be melted first and the finer material added to the molten mass in the crucible. At no time should the metal in the crucible be heated above the temperature at which it becomes thoroughly molten. If fine scrap such as turnings and borings or fine wire is to be melted, some coarser scrap or ingot metal should be melted down first so as to fill the crucible about half full of molten metal. The fine material should then be introduced into the crucible and pushed down into the molten metal with a rod. To prevent the oxidation of material of this kind an old crucible should be taken, the bottom knocked out, and this may be used as a funnel for feeding the fine material into the pot.

New Processes for Case-hardening Steel

By F. J. Giolitti

The effects of the various elements and their compounds on steel in case-hardening.

Three essential conditions in case-hardening and the principal advantages obtained by the employment of agents that satisfy these conditions.

The results of estimations of the carbon in successive layers obtained by case-hardening with a mixed agent followed by exposure to the action of carbon monoxide.

*Excerpts from a paper presented before the Iron and Steel Institute.

1. Where case-hardening is carried out with solid cementing agents having a carbon base, the carburizing effect of the free carbon on the iron, the materials being in simple contact and without the intervention of gaseous carbon compounds, is exceedingly weak, and in any case is entirely negligible in industrial practice. This assertion has been fully confirmed by the more recent investigations of Guillet, Griffith, Weyl, and Charpy. The last-named experimenter even comes to the conclusion, already dealt with by others, that the direct effect of carbon in cementation with solid agents is absolutely nil.

2. Where case-hardening is effected with the solid case-hardening agents ordinarily employed in the industry, the specific effect of the nitrogen is very weak, as admitted and variously explained by many investigators. Only with the cementing agents containing a high proportion of the cyanogen compounds (alkaline cyanides, ferrocyanides, etc.), does the direct action of volatile nitrogen compounds have any marked effect.

3. As compared with the cementing effect of the solid agents ordinarily employed in the industry, the specific direct carburizing effect of carbon monoxide preponderates enormously over every other carburizing effect.

4. Pure carbon monoxide carburizes iron at all temperatures within the range (700 degrees to 1300 degrees Centigrade) at which the process of case-hardening can be performed by means of any other medium whatever. Moreover, the rate of case-hardening (by which is understood the depth of carburization which can be obtained in a given time) when working under suitable conditions is greatest when carbon monoxide, or a mixture in which the carbon monoxide can efficaciously exercise its specific carburizing effect, is used as the agent.

5. This specific carburizing effect exerted by the carbon monoxide on the iron at high temperature is due to a series of chemical reactions, the course and state of equilibrium of which have been actually observed with precision. Moreover, the conditions of equilibrium of the systems in which these reactions take place are in general comprised within the ranges of temperature and pressures ordinarily employed in practice. It is, therefore, possible to obtain with certainty a predetermined result using case-hardening agents whose activity is due, if not exclusively, at least very largely, to the specific carburizing action of the carbon monoxide. More particularly, it is possible to obtain with such agents carburized zones in which the concentration of the carbon does not exceed a predetermined maximum limit and varies in a well-defined degree toward the inside of the carburized zone. Such definite results, variable at will within sufficiently wide limits, are obtained by varying, in accordance with fixed rules, the temperature at which the case-hardening is performed, the pressure of the carburizing gas, and the amount of carbon monoxide which, in a given time, comes in contact with the unit surface of the steel to be carburized.

6. The results obtained by the use of carbon monoxide as an agent vary regularly, other conditions being equal, as the chemical composition of the steel to be carburized is varied.

7. It is possible to vary regularly and and within fairly wide limits the characteristics of the desired product by subjecting the steel to the action of substances along with carbon monoxide which are capable of modifying the conditions of equilibrium of the chemical systems under which the reactions due to the specific carburizing effect of the carbon monoxide are completed. Such substances may be gases, such as hydrocarbons or nitrogen, or they may be solids such as carbon in various forms, and their actions can proceed simultaneously with that of the carbon monoxide throughout the whole cementation period or during a portion only of it.

8. In particular, by means of the agents, the activity of which is due to the specific carburizing effect of carbon monoxide, it is possible to obtain with ease and certainty—whatever kind of steel is being operated upon—soft case-hardenings and graduated case-hardenings; that is to say, carburized zones in which the concentration of the carbon, without being excessive in the outer layers, diminishes slowly and with regularity in the succeeding deeper layers. This is the essential condition for the avoidance of the dangerous phenomenona of brittleness and peeling, which defects manifest themselves so frequently in steel pieces case-hardened by the processes ordinarily used in the industry.

9. The chemical reactions produced by agents in which cyanogen is the active element, are at present but imperfectly understood, particularly as regards their condition of equilibrium, upon which depends the concentration of carbon in the carburized zones. It is, however, certain in the conditions under which case-hardening should be performed in practice that the conditions of equilibrium just now alluded to should closely correspond to the strength of the very high concentration of carbon passing into solution in the iron. Thus it happens that the cyanides, ferrocyanides, and other derivatives of cyanogen, if used alone as case-hardening agents, always give rise to too rapid (energetic) a case-hardening. That is, carburized zones are produced in which the concentration of the carbon is excessively high in the outer layer up to a certain depth and is then suddenly lowered in the succeeding layers. Zones of that type, the formation of which has been fully studied and their cause explained by the author, produce brittleness and peeling.

10. Further, gaseous or volatile hydrocarbons, when used alone as agents, also give rise to too rapid case-hardening, the causes being identical with those referred to in the case of cyanogen and its compounds.

Three Essential Conditions

I. The chemical composition of the agent should be absolutely definite, and should be accurately known.

II. The compounds should be as simple as possible.

III. The reactions which take place during case-hardening process, between the various constituents of the agent and those of the steel should be simple, and should proceed rapidly—under the conditions most easily obtaining in practice—to a well-defined state of equilibrium corresponding to definite concentrations of carbon in the carburized zones. Below are enumerated the principal technical advantages which the author has shown to be obtainable by the employment of case-hardening agents, which satisfy the three essential conditions previously mentioned and, in particular, of the "mixed" agent based on the simple simultaneous action of carbon and carbon monoxide. The following are the principal advantages:

No. of the Range of Single Layers Analyzed	Distance from the Surface of the Central Portion of the Layer Analyzed	Amount of Carbon in the Single Layers		
		First Determination, Per Cent.	Second Determination, Per Cent.	Mean, Per Cent.
1	0.5 mm. or 0.02 inch	1.16	1.18	1.17
5	2.5 mm. or 0.10 inch	0.80	0.82	0.81
10	5.0 mm. or 0.20 inch	0.33	0.35	0.34

(*a*) of Series I. Case-hardening for ten hours at 1100 degrees Centigrade (2000 degrees Fahrenheit) with the mixed agent:

No. of the Range of Single Layers Analyzed	Distance from the Surface of the Central Portion of the Layer Analyzed	Amount of Carbon in the Single Layers		
		First Determination, Per Cent.	Second Determination, Per Cent.	Mean, Per Cent.
1	0.5 mm. or 0.02 inch	0.84	0.86	0.85
5	2.5 mm. or 0.10 inch	0.76	0.80	0.78
10	5.0 mm. or 0.20 inch	0.46	0.46	0.46
15	7.5 mm. or 0.30 inch	0.23	0.27	0.25

(*b*) of Series I. After reheating the same carburized zone for five hours at 1100 degrees Centigrade (2000 degrees Fahrenheit) in isolated carbon monoxide:

No. of the Range of Single Layers Analyzed	Distance from the Surface of the Central Portion of the Layer Analyzed	Amount of Carbon in the Single Layers		
		First Determination, Per Cent.	Second Determination, Per Cent.	Mean, Per Cent.
1	0.5 mm. or 0.02 inch	0.69	0.71	0.70
5	2.5 mm. or 0.10 inch	0.66	0.68	0.67
10	5.0 mm. or 0.20 inch	0.52	0.54	0.53
15	7.5 mm. or 0.30 inch	0.38	0.40	0.39

(*c*) of Series I. After reheating the same zone another five hours (altogether ten hours of reheating) at 1100 degrees Centigrade (2000 degrees Fahrenheit) in isolated carbon monoxide:

No. of the Range of Single Layers Analyzed	Distance from the Surface of the Central Portion of the Layer Analyzed	Amount of Carbon in the Single Layers		
		First Determination, Per Cent.	Second Determination, Per Cent.	Mean, Per Cent.
1	0.5 mm. or 0.02 inch	1.18	1.14	1.16
5	2.5 mm. or 0.10 inch	0.79	0.82	0.81
10	5.0 mm. or 0.20 inch	0.49	0.51	0.50

The results after each single phase of treatment are as follows:

(*a*) of Series II. Case-hardening for ten hours at 1100 degrees Centigrade (2000 degrees Fahrenheit) with the mixed agent:

No. of the Range of Single Layers Analyzed	Distance from the Surface of the Central Portion of the Layer Analyzed	Amount of Carbon in the Single Layers		
		First Determination, Per Cent.	Second Determination, Per Cent.	Mean, Per Cent.
1	0.5 mm. or 0.02 inch	0.80	0.81	0.80
5	2.5 mm. or 0.10 inch	0.76	0.78	0.77
10	5.0 mm. or 0.20 inch	0.58	0.58	0.58
15	7.5 mm. or 0.30 inch	0.45	0.44	0.45

(*b*) of Series II. After reheating the same carburized zone for five hours at 1100 degrees Centigrade (2000 degrees Fahrenheit) in isolated carbon monoxide:

No. of the Range of Single Layers Analyzed	Distance from the Surface of the Central Portion of the Layer Analyzed	Amount of Carbon in the Single Layers		
		First Determination, Per Cent.	Second Determination, Per Cent.	Mean, Per Cent.
1	0.5 mm. or 0.02 inch	0.87	0.85	0.86
5	2.5 mm. or 0.10 inch	0.85	0.88	0.87
10	5.0 mm. or 0.20 inch	0.75	0.75	0.75
15	7.5 mm. or 0.30 inch	0.60	0.58	0.59

(*c*) of Series II. After reheating the same zones for a further five hours (total reheating period ten hours) at 1100 degrees Centigrade (2000 degrees Fahrenheit) in isolated carbon monoxide:

1. The great speed of penetration of the carburized zone. That fact, if, indeed, it does not constitute the chief value of any given case-hardening process, as many manufacturers still believe, is certainly most advantageous on economical and technical grounds too numerous to mention.

2. Great uniformity in the distribution of carbon in the carburized zones, on account of the fact, as already stated, that the peeling of case-hardened and tempered pieces is reduced to a minimum.

3. The possibility of regulating, either by diluting the carbon monoxide with nitrogen, or by limiting the contact of the solid carbon with the surface of the steel, or by suitably varying the temperature during the case-hardening process, the concentration of the carbon in the carburized zone so as to maintain it within the most suitable limits for conferring the maximum hardness combined with minimum brittleness. The extent of carburization must, of course, vary according to the composition of the steel subjected to cementation.

4. The possibility of establishing with certainty from the start the necessary conditions for obtaining a predetermined result which may be chosen within sufficiently wide limits, and may be obtained with great accuracy.

5. Continuous use of the same carburizing materials (solid carbon and carbon monoxide), which do not become attenuated, but may be used up to their last residue. This also permits of carburizing to any depth wthout the necessity of renewing the agent during the operation.

6. Absolute security against the introduction into the steel of any foreign substance apart from the carbon. This is an advantage of the highest importance in most cases, and cannot be realized in the case of most of the case-hardening powders habitually used, consisting of organic nitrogenous substances, such as alkaline cyanides, or ferrocyanides.

7. The ease with which the surface of the case-hardened pieces is preserved without alteration, thus obviating the necessity of any subsequent dressing of the case-hardened pieces.

8. The deformation and change of volume which the steel pieces may undergo during case-hardening are reduced to a minimum. In case it is possible to determine from the start the extent of such volume changes as may occur.

The following data refer to case-hardenings of medium depth (from 5 to 10 millimeters, 0.2 to 0.4 of an inch), in which the application of the process in question presents the greatest technical interest, particularly in the case of very deep case-hardenings. In the accompanying tables are collated the results of estimations of the carbon in successive layers of a thickness of 0.5 millimeter (0.02 of an inch), obtained by

case-hardening with the mixed agent, followed by exposure to the action of isolated carbon monoxide. In the tables the exact conditions are stated under which the two distinct phases of the operation are conducted.

The hot granular carbon employed by the author for case-hardening with his mixed medium constitutes a mass which, particularly at high temperatures, is endowed with a mobility comparable to that of a liquid. On this account it is able to penetrate simply by its own weight into all crevices among the articles to be case-hardened, and between these and the walls of the retort. The filling up may be further assisted by means of iron rods introduced through holes in the cover and manipulated by the operator who stands on the furnace.

Results with Mild Steel

Series I—The material used was an ordinary mild steel of the following composition:

	Per Cent.
Carbon	0.12
Silicon	0.06
Manganese	0.47
Sulphur	0.02
Phosphorus	0.03

The results after each phase of treatment are shown in the accompanying tables.

Chromium Nickel Steel

Series II—The material used was a chromium nickel steel of the following composition:

	Per Cent.
Carbon	0.33
Silicon	0.06
Manganese	1.15
Sulphur	0.02
Phosphorus	0.015
Chromium	1.50
Nickel	3.17

The results after each phase of treatment are shown in the accompanying tables.

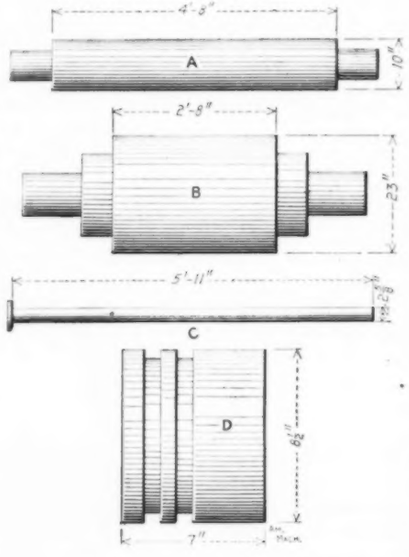
Examples in Modern Grinding

From the time that the grinding machine has been used as a manufacturing tool, its development has been remarkable. Only a few years ago finishing surfaces by grinding was considered good practice only when dealing with hardened material. In this case it was a necessity, but when used as a means of finishing soft metal, it was considered excessively expensive, which might have been due to the fact that the grinding machine, at that time, was inefficient, but it was at least found to produce work of a much higher quality than by filing and polishing; however, what was needed was a machine that could produce work accurately and quickly, and this condition has been responsible for the machine as it exists today.

The infant grinding machine carried wheels of from ⅛ to ½ inch in thickness, and had a traverse movement of from $\frac{1}{10}$ to ¼ inch per revolution of work, while the machine of today carries wheels of from 2 to 5 inches and commonly has a traverse movement of from 1 to 4¾ inches per revolution of work.

In the accompanying cuts are shown examples of interesting jobs that are the product of the modern grinding machine. For instance, on the piece shown at *A*, 0.220 inch was removed from the diameter at a surface speed for the work of 28 feet; traverse movement of wheel 2¼ inches roughing, 1½ inches finishing; wheel feed, 0.013 inch; wheel used, carborundum, 2½x18 inches, grade 36 N, O D bond; material, chilled iron; time complete, 6 hours; number of cubic inches removed per minute to finished surface, 0.53.

These rolls were ground from the rough and given a high finish with a limit of variation of 0.0005 inch.



Examples of Modern Grinding

At *B* the material was chilled iron; removed from the diameter, 0.032 inch; time, 90 minutes; surface speed of work, 30 feet; wheel used, American Corundum, 24x3 inches, grain 60, grade J; wheel traverse, 1½ inches per revolution of work; cubic inches removed per minute to finished surface, 0.40 inch.

In grinding chilled-iron rolls where an extremely high finish is required, it is sometimes necessary to give the grinding wheel a somewhat smaller traverse movement and this movement is sometimes as small as ½ inch, when using a wheel 2 inches in width.

By the foregoing examples it will be seen that wheels of a comparatively soft grade were used, which is good practice in grinding hard material, the standard rule for selecting grinding wheels being, for hard metal a soft wheel, and for soft metal a hard wheel. It is my belief that in grinding soft metal too much has been expected of hard wheels, for to grind economically a wheel must wear in order to keep sharp and free cutting, and, by the example shown at *C*, it will be seen that while the wheel was of a softer grade than generally used, the results were excellent.

On the piece referred to, 0.075 inch was removed from the diameter, the material being soft steel; time, 40 minutes; limit of variation, 0.00025 inch; wheel used, Aloxite, grade 303 O, bond D 496; wheel traverse, 3 inches per revolution of work; surface speed of work per minute, 15 feet; cubic inches removed per minute to finished surface, 0.54.

This work was roughed down to within 0.003 inch of finished size, no difficulty being experienced in getting the work to run perfectly true, which can be attributed to the fact that by using the soft wheel a good, free-cutting action took place, and that spring rests were used, which allowed the work to center itself as it was freed from internal strains. It is also very important that a spring tension be used in connection with the tail center to allow longitudinal changes in the work while being ground.

The gas-engine piston shown at *D* was finished in one operation, it being only necessary to true the grinding wheel after grinding every seven or eight pistons. The material was cast iron; surface speed, 80 feet per minute; wheel used, carborundum, grade and grain 403 P, bond O F, size 2x24 inches; wheel traverse, 1⅞ inches per revolution of work; removed from diameter, 0.040 inch; cubic inches removed per minute to finished surface, 0.40 inch; time, 9 minutes.

By comparing the above methods to those employed a few years previous, it will be found that they are far superior by reason of the decrease in amount of time taken to get the results, which is made possible by the modern grinding machine, embodying all the features that go toward rapid production of work of a superior quality.

In general practice, work should be finished in one operation where applicable, but this cannot always be done, depending greatly on the quality of the job. When grinding work in two operations, it is always advantageous to grind close to the finish size in the roughing operation, allowing just enough on the piece to insure its truing nicely.

A water soluble bond extensively used in the foundry is glutrin, a byproduct of paper manufacture by the sulphite process. The sap stored in the cells of the spruce wood used in paper making is extracted by boiling with the sulphite solution and when treated to remove certain undesirable elements, and concentrated, it becomes the binder known as glutrin. While its composition is complex, consisting of tannins, wood sugars and resin in soluble form, it is a byproduct uniform in composition and hence in binding power, and it will not ferment.

Special Tap Making Machinery

By Ethan Viall

Details of a complete set of tap-making appliances intended for manufacturing purposes.

How the squaring and fluting mechanism works; how the taps are relieved and threaded.

Details of a "jumping" mechanism that prevents waste of time on threading jobs with widely separated lands.

Making the hobs and grinding the cutters.

Many firms using taps in quantities find it profitable to make their own, in order to thereby meet their own peculiar conditions, as very often stock taps purchased on the open market are unsatisfactory for special work, and it is to assist these firms as well as the regular tap manufacturers, that the Bickford Machine Company, of Greenfield, Mass., is manufacturing a line of tap-making machinery, designed to perform every operation incident to tap making from the bar to the finished product.

The tap-hobbing machine, shown in order to make the chain complete, was described in detail with special reference to pipe taps, nearly three years ago, and the fluting machine some time later, but with these exceptions the machines shown have been untouched by the technical journals, and the line, in its completeness, is here described for the first time.

Stages of Manufacture

While the machines described will regularly handle taps of any style of from four to eight flutes, ⅛ to 4-inch pipe or 3/16 to 4-inch standard, the present article, for the sake of clearness, will be confined to the making of small hand taps, the principal steps in the manufacture of which are shown in Fig. 1.

Taking the steps in order, the taps are cut from the bar and formed as shown at *A;* then they are centered as at *B;* next the ends are squared and then they are fluted and the name and size rolled on, as shown by *C* and *D*, respectively; following this, the taps are relieved and the threads cut as at *E* and *F; G* shows the way they come from the hardening room, while *H* and *I* illustrate two stages of the final polishing.

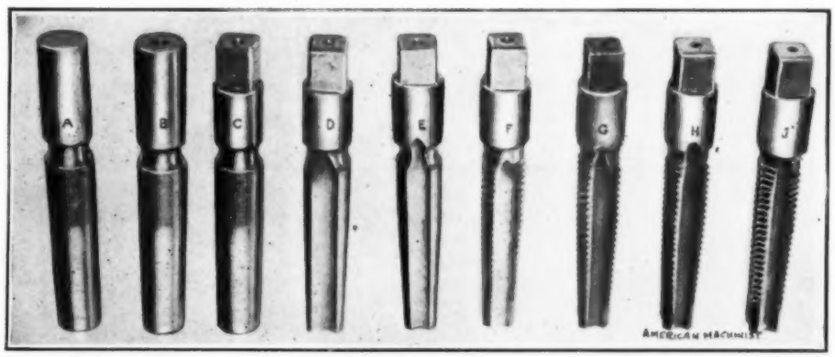


Fig. 1. Stages in the Manufacture of a Hand Tap.

The above procedure is followed, with only minor variations, in the making of taps in general.

Fig. 2 shows the automatic machine used to form the tap blanks from bar stock. This machine has no turret, as only a center drill, carried in the end of sliding bar *A*, and a stop *B*, are needed in addition to the forming tool *C* and cutoff *D* on the cross slide. Designed as the machine is for tap work, the manufacturer who buys one does not have to pay for a lot of extra attachments which are of no use to him for his special purpose.

Centering the Tap Blanks

While the machine just referred to centers the small end of the tap, it is necessary to center the other end also, and for this purpose the machine shown in Fig. 3 has been designed to do the work quickly and accurately. The blank is driven from the spindle by means of the hollow four-ridged chuck *A*, and is guided and steadied by the V-block *B*, which may be adjusted to suit various-sized taps. Two of the driving chucks for large taps are shown at *C* and *D*, and will give a better idea of the way they are made. The center drill is carried in the split chuck *E* and is fed in by the hand lever *F*, which works the slide. Very rapid work can be done on this machine, as the operator handles the blanks with his left hand and feeds in the drill with his right, the form of chuck and steadyrest used making it unnecessary to stop the spindle.

Squaring the Ends

The ends of the taps are automatically squared, four at a time, in the machine shown in Fig. 4. The ends to be squared are supported on tail centers set into the edges of the vertical bars *A* in bracket *B*, and the small end is held in internally ridged four-jawed centers *C*, the jaw ridges of which are angled back sharply to prevent the tap blanks from turning under the twisting strain of the milling. These centers are forced onto the tap ends by means of the hand screws shown at the left. The indexing and feeding mechanism is so similar to that used on the fluting machine, that the following description of the latter will do for both.

Fluting

The principal difference between the squaring and the fluting machines is in the method of holding the work, the tail centers of the latter being held to the work by strong springs, and are operated by hand levers, as shown at the right in Fig. 5, which is possible because fluting does not have the tendency to twist the blanks that the squaring does, and allows the use of a quicker-acting lock.

Four blanks are fluted at a time, and after the machine is set and started, it automatically feeds and indexes until the four flutes, or whatever number it is set for, are finished, when the table motion stops and the machine is ready for refilling, and this stopping is accomplished by means of the trip *A*, which is turned a quarter way around each time the taps are indexed, so that as the table is reversed after the fourth flutes are cut, the round part of the trip strikes pin *B* and forces bar *C* down, which in turn, by means of pin *D*, forces down the end of the lever *E* and allows bracket *F*, carrying the table-driving worm, to drop down, throwing the worm out of mesh with the rack gear, which remains constantly in mesh with the special curved rack, and which is in reality a quarter section of a screw.

When milling three of the flutes, the flat sides of trip *A* pass over the end of pin *B*, and it is only on the last reverse that the trip works, so in starting the first flute the pin *B* is thrown over and held until the trip *A* is clear, while the feed is thrown in by pulling up on handle *G*, which brings the worm into mesh again.

The bracket *H* may be set at any place that is necessary along the bar to accommodate different lengths or positions of taps.

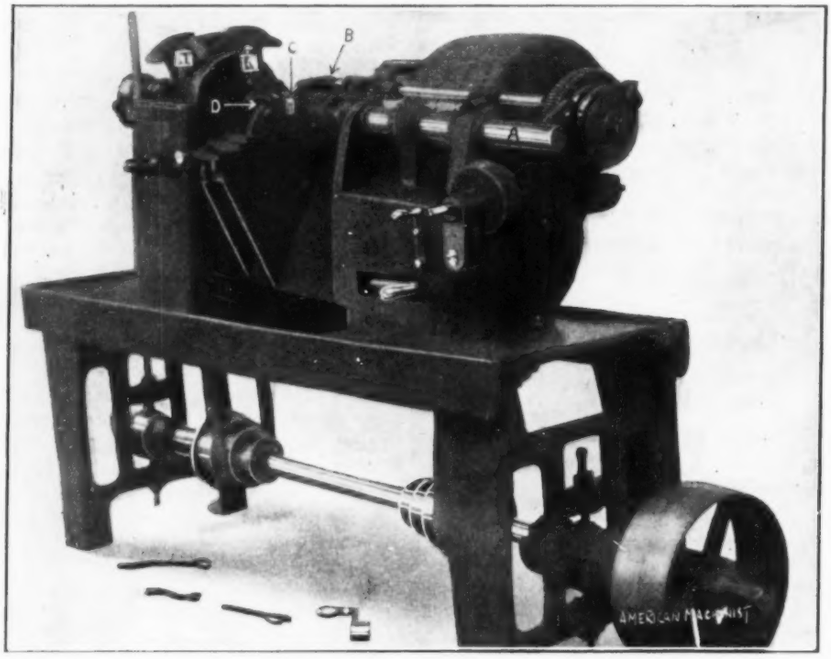


FIG. 2. AUTOMATIC MACHINE FOR MAKING TAP BLANKS FROM THE BAR

THE INDEXING MECHANISM

The indexing of the centers is accomplished by means of the gear *I*, on the end of an intermittently operated shaft, which causes the bevel gears *J* and *K* to rotate and revolve the chain of gears *L*, *M*, *N* and another, not shown, on the same shaft as bevel gear *K*, the movement of which will be better understood by a study of Fig. 6.

In this halftone, the disk *A* is keyed to the shaft that runs through the head and drives the gears just described. The disk, and consequently the shaft and gears, is locked in turn at each of four positions, by means of the notches in its rim into which the hooked end of dog *B* fits. As the table feeds forward on a cut, disk *A* remains stationary, being locked by the dog *B*, but ratchet disk *C* revolves in the direction indicated by the arrow being turned by lever *D*, causing a tension in spring *E*. Then as the table reverses and travels back, the outer end of dog *B* strikes stop *F*, unlocking disk *A*, which at once commences to revolve, being pulled around by the spring and ratchet disk, the chain of gears and the four centers, of course, revolving with it.

As the disk *A* revolves, one of the pins *G* strikes the end *H* of the stop, throwing end *F* out from under the dog and allowing it to lock into the next notch in the disk. The table now reverses and feeds forward, the stop *F* being pulled forward till clear of the dog, when the small spring *I* snaps it back into position.

THE TABLE REVERSE

The table-reversing mechanism is operated by means of stops *J* and *K* on the disk *L*, which is connected to the table rack by means of a shaft in the rack gear referred to above, so that as the table moves, the disk *L* revolves according to the direction in which the table is moving and one of the stops will strike pin *M* on the universal-jointed shaft *N*, throwing the reverse clutch in the gear box *O*, an enlarged view of which is shown in Fig. 7.

In this halftone *A* is the driving shaft and *B* the one for throwing the reverse clutch. There are two notches in disk *C*, into which the spring-actuated latch *D* fits, for the two positions of the clutch. As the shaft *B* is twisted by the action of one of the stops previously referred to, the point of *E* presses down on the hardened roller *F* and forces the latch out of the notch in the disk *C*, and then as the point passes the center the spring suddenly forces *F* up, throwing both *E* and *C* around, causing *G* to swing on pin *H* and throw the clutch *I* to the opposite side, bringing the other set of gears into use. By the use of this mechanism it is impossible for the sliding clutch to take a neutral position, or in other words, the feed shaft is either going forward or backward at all times. These gears are so arranged that the miller table travels back at five times the speed with which it feeds forward.

The machine just described will flute on an average 800, ¼-inch; 600, ½-inch; 400, ¾-inch; 300, 1-inch or 250 1¼-inch taps in a 10-hour day.

MARKING

The figures and lettering placed on the shank to indicate the size and name of the firm making the taps are rolled in by placing the taps, one at a time, in the machine as shown at *A*, Fig. 8. and pulling on the hand lever B, the figures and letters being set into the holder *C*. As the lever is pulled the tap rolls to the left, the markings being imprinted as it rolls and at the end of the stroke the tap is removed, the lever thrown over to its original position and another tap placed in the machine.

This machine is different from the ordinary rolling press, in that the work is not held solid against the imprinting die but is pressed upward by a spring plunger, a knuckle joint lock being used to open up the space where the work is inserted, and operated by pressing down on a foot lever attached to the rod *D*. The foot lever can, of course, be pressed down only a certain distance and any variation needed in the spring tension can be obtained by turning the large nut *E*, which is locked by the pin *F*. The plunger supporting the work table is so made that shanks larger than the maximum size for which the machine is set cannot be rolled, as the gap *G* between the top of the plunger and the collar *H* is closed

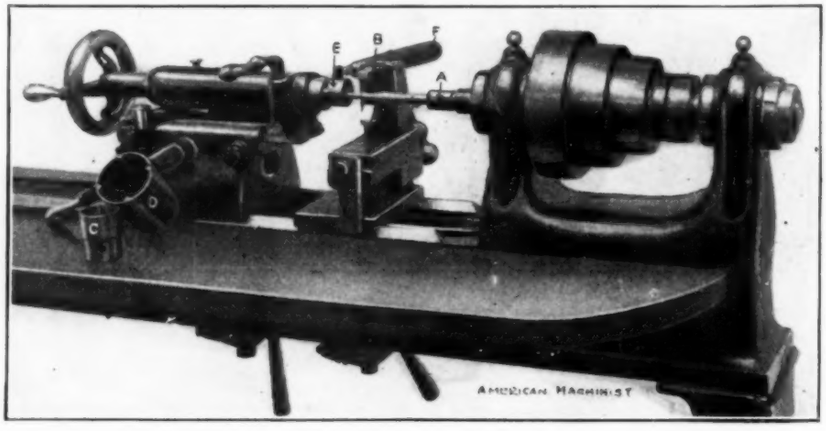


FIG. 3. THE CENTERING MACHINE

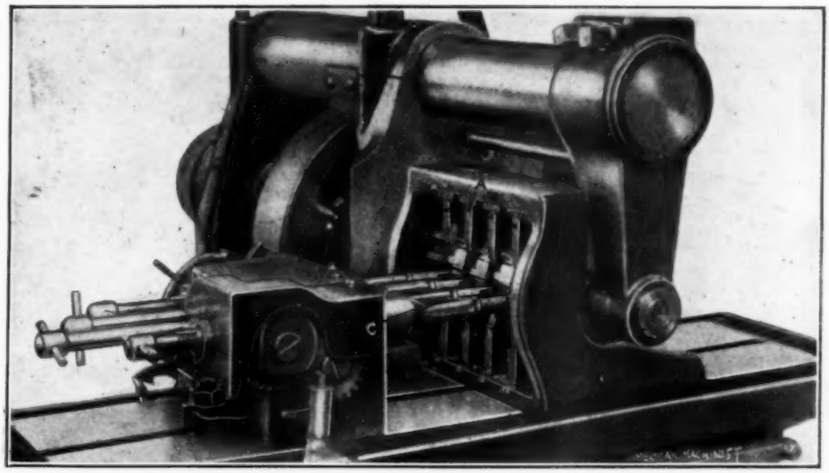


FIG. 4. SQUARING THE ENDS

threads, which is shown in Fig. 10, has been previously described, but for the benefit of those not familiar with the machine, a brief outline of its principal features will be given here.

The tap blank is held as in the relieving machine, but is set straight or taper, according to the style of tap to be hobbed and in the process of hobbing the tap must be given a lead, obtained by means of a master lead screw *A*, which feeds the carriage along, a split nut *B*, operatedby lever *C*, being used to release the lead screw when setting or running the carriage back.

Relief in the threads may be obtained by using the cam *D* exactly the same way as on the relieving machine. The tap is fed onto the hob by turning the screw *E*, which draws in the carriage.

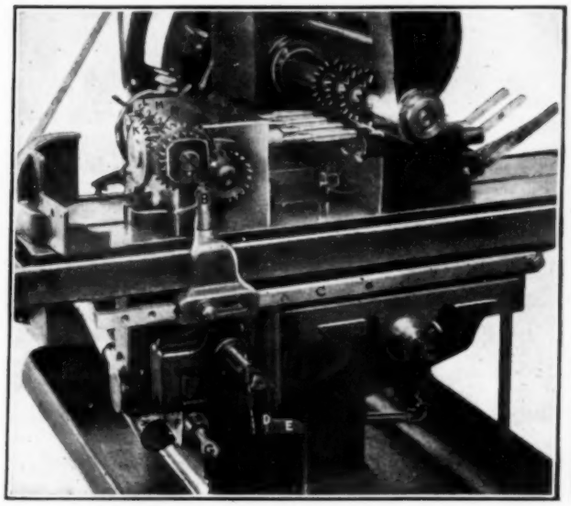


FIG. 5. CUTTING FLUTES IN FOUR TAPS AT ONCE

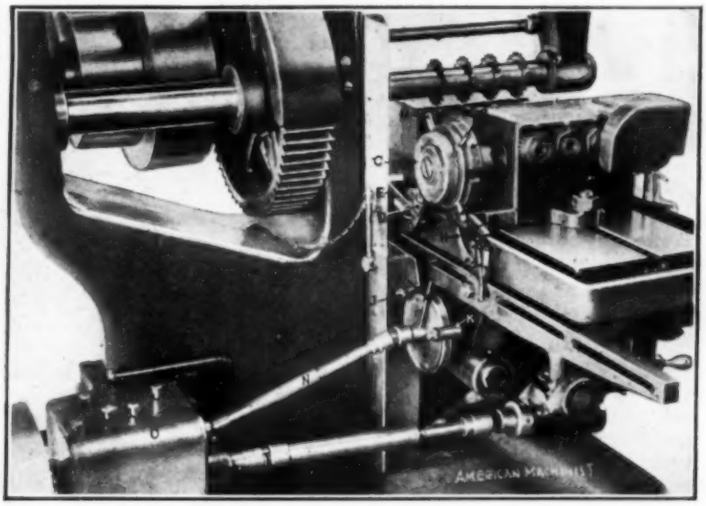


FIG. 6. DETAILS OF THE FEEDING AND INDEXING MECHANISM

so that the table rests solid and cannot be forced down farther, making it impossible to get a tap under the sliding holder.

RELIEVING

Ordinary taper-end taps are relieved before they are threaded and it is done automatically on the machine shown in Fig. 9. The tap is placed between centers at *A* and is set at the proper angle for the taper, by moving the slide *B*. Drive for the tap is obtained from the spindle *C*, and as the tap rotates the relief of the lands is obtained by movement of the carriage with relation to the milling cutter *D*, caused by the cam *E*, the carriage being held in contact with the cam by weight *F*.

When the four lands have been relieved, which requires but one complete revolution of the tap, the hook finger *G* catches on a stop pin, and pulls down lever *H*, which releases lever *I* and throws out the main clutch, stopping the machine.

THREADING

As stated at the beginning of this article, the machine used for hobbing the

A tap is threaded at each revolution of the work spindle at an approximate rate of two hundred and fifty ⅜-inch standard taps in 10 hours, and others in proportion.

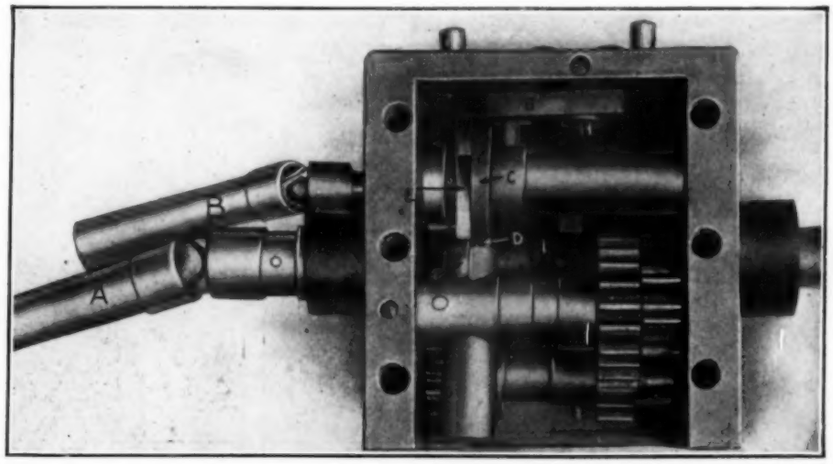


FIG. 7. DETAILS OF THE REVERSING GEAR BOX

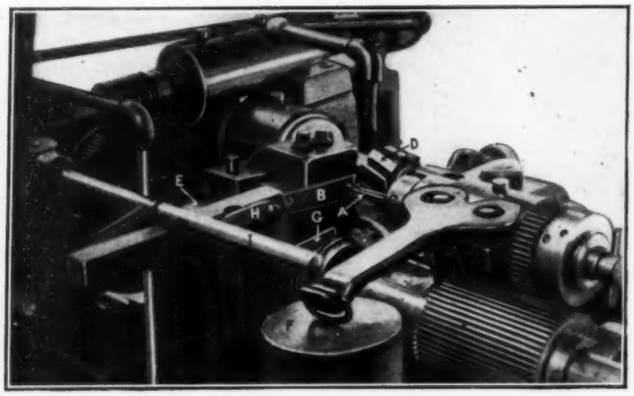


FIG. 9. RELIEVING TAPER END TAPS

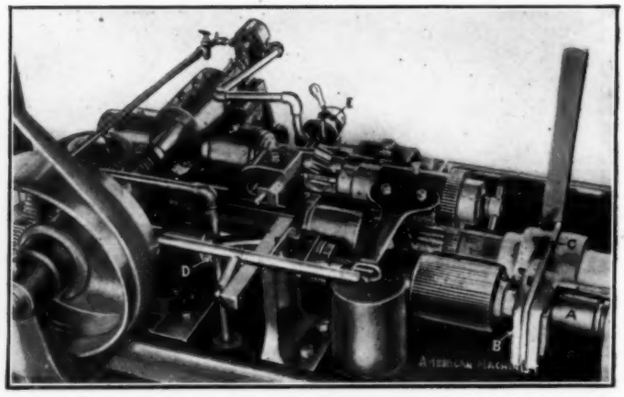


FIG. 10. HOBBING THE THREADS

A "JUMPING" ATTACHMENT

An adaptation of this tap-hobbing machine, which, while having no connection with tap making but probably best described in conjunction with the foregoing, is used to hob the threads on pipe wrenches. In the threading of these for the adjusting nut, the width of each land is, in many cases, as small as one-eighth of a revolution, so that if no arrangement were made for jumping the spaces, the hob would "cut air" nearly three-quarters of the time, and to obviate this unnecessary waste of time, the regular tap-hobbing machine has been fitted with the special attachment shown at *A*, Fig. 11, a pipe-wrench jaw being shown at *B*.

Fig. 12 gives a better view of the mechanism used to speed over the blank space, and in this halftone *C* is the main driving pulley, which, while the hob is cutting, drives the cam shaft and hence the work spindle, through the worm and worm gear *D* and *E* and the two gears *F* and *G*, which turn in the direction indicated by the arrows, the dog *H* locking in the ratchet *I*, keyed to the cam shaft. The worm gear *J* is loose on the cam shaft in the same way as gear *G*, and it also carries a dog which engages the teeth of a ratchet keyed to the cam shaft between gears *J* and *G*. Now it will be plain that whichever one of the two

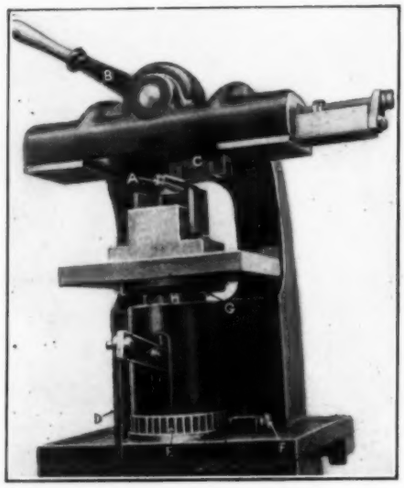


FIG. 8. MARKING MACHINE

gears *J* or *G* moves the faster will drive the cam shaft and work spindle, the dog slipping on the slower.

Pulley *K* is belted to and run continuously by pulley *L*, but worm *M* and gear *J* remain stationary until the clutch *N* is thrown in, when the gear *T* will revolve at a much higher rate of speed than gear *G*, owing to the speed ratios which are about 30 to 1. Now the work spindle is driven through gear *G* until the hob is through cutting one land, when the cam throws in clutch *N* and the work spindle is driven thirty times as fast by gear *J* until the next land is reached, when the cam throws out the clutch *N*, reducing the speed to normal for the next hobbing operation.

CUTTING THE HOBS

Hobs for use in the threading machines are made on the same machines in which they are used, the hob being placed on a mandrel between the centers of the work spindle and a master-thread mill placed on the hobbing spindle, as shown at *A* and *B*, respectively, in Fig. 13. These hobs are made about ¼ inch longer than the length of the threaded portion to be cut, and are from 2¼ to 3 inches diameter, milled with ten spiral flutes having an approximate lead of 30¾ inches to one turn and the teeth are cut circular and not helical, so the lead screw *C* is only used to feed the carriage along by hand, using the handle *D* at the end of each revolution of the hob and is not used while the cutter is working, the bell *E* being placed on the trip lever so as to notify the operator to feed the hob blank along and start another cut.

Of course, hobs for cutting straight taps are not, as a rule, the same as those for taper taps, though a hob cut with a master cutter, the angles of whose teeth are 31 and 29 degrees, will cut straight taps with an error of one degree and with

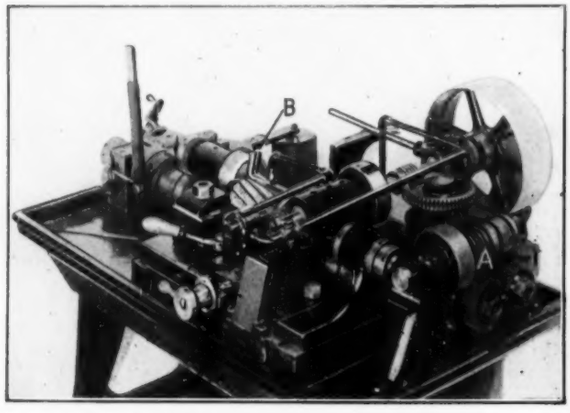


FIG. 11. HOBBING THREADS ON WRENCH JAW

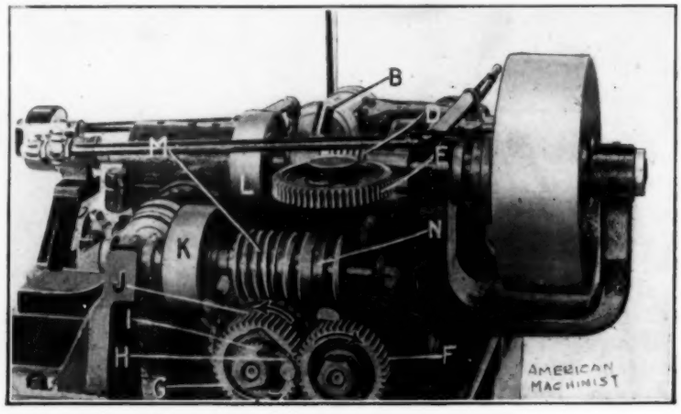


FIG. 12. DETAILS OF THE JUMPING ATTACHMENT

an error of ¾ of one degree for taps tapered ¾ inch per foot.

For Whitworth threads a special formed cutter must, of course, be used for each pitch.

Sharpening Hobs and Fluting Cutters

It is essential that the cutting ends of the hob teeth be ground perfectly radial in order to do good work, and for this reason it is necessary to have suitable fixtures for the purpose, so the combination machine, shown in Fig. 14, has been made, one end being used for grinding hobs and the other for grinding fluting cutters.

From the halftone it will be seen that the hob *A*, to be ground, is mounted on a mandrel with a master form *B*, which is guided and correctly rotated by the finger in the end of bracket *C*, as the table is run back and forth by means of the lever *D*. The hob teeth are adjusted to the grinding wheel by the screws *E* and *F*, which move the finger and consequently slightly rotate the master form together with the hob. By this method of adjustment the teeth are kept radial, which would not be the case were the table moved for the purpose.

Vertical and also angular adjustment of the table is obtained by loosening clamping bolts and turning the hand screw *G*, the table support *H* being keyed to a sleeve *I* to prevent its turning when the clamp bolts are loosened, this sleeve being released by another bolt not shown.

The fluting-cutter grinding-fixture is at the right-hand end of the grinder spindle and has a table *A*, which swings about a center and is operated by the lever *B* and link *C*. This table carries the cutter support or head *D*, the cutter being placed at *E*. The indexing is done by means of the handle *F*, and a ratchet index plate on the side opposite the cutter. This handle is also used to swing the head *D*, thus causing the wheel to grind in a circle over the top of the cutter tooth *H*. Feeding of the cutter onto the grinding wheel is done with the hand screw *G*, which does not change the radius, as the screw moves the slide into which the swinging table is set.

Hardening and Drawing

Along with the machines for making the taps, complete sets of furnaces are furnished, and Fig. 15 shows an oil-burning hardening furnace at *A*, a water-jacketed oil bath being set directly in front, into which the taps may be dropped by simply raking them out of the heating chamber.

Two tempering furnaces are shown at *B* and *C*, which are also oil heated, being so made that a very uniform temperature of any degree suitable for proper drawing may be maintained.

Polishing

The shanks of the hardened taps are polished on the wheels shown in Fig. 16, which are mounted on a good, solid stand, amply heavy for the work for which they are intended. The spindle is belted from

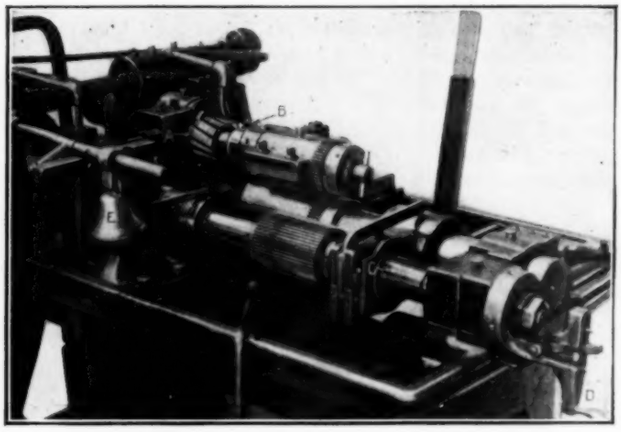


Fig. 13. Cutting Hob Teeth on a Regular Tap Hobber

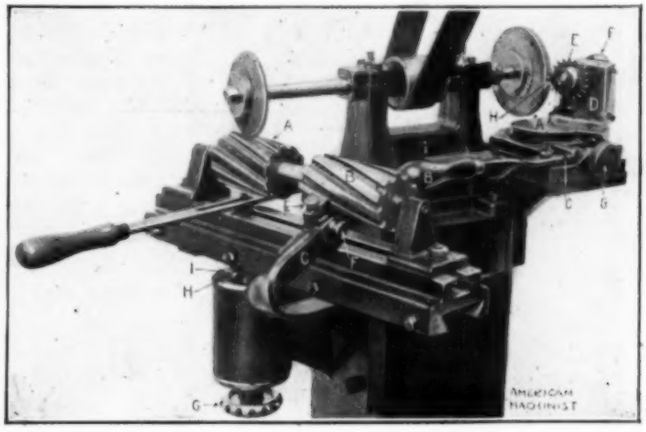


Fig. 14. Grinding Machine for Hobs and Fluting Cutters

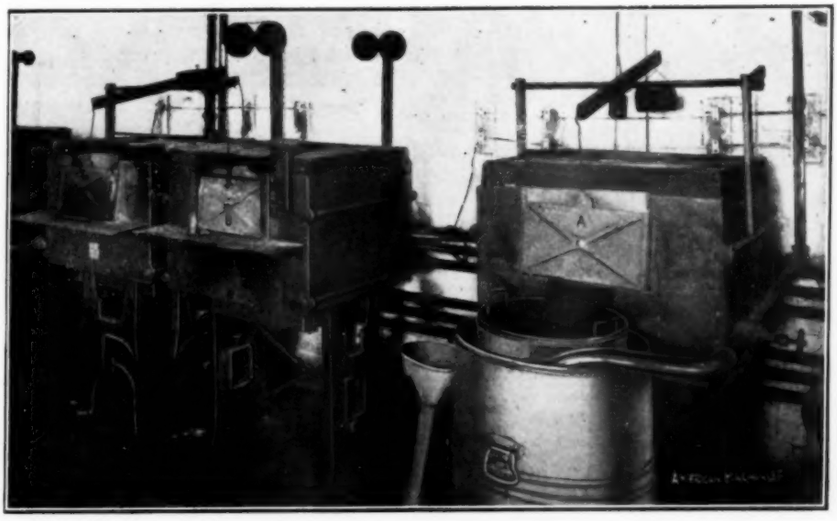


Fig. 15. Hardening and Tempering Furnaces

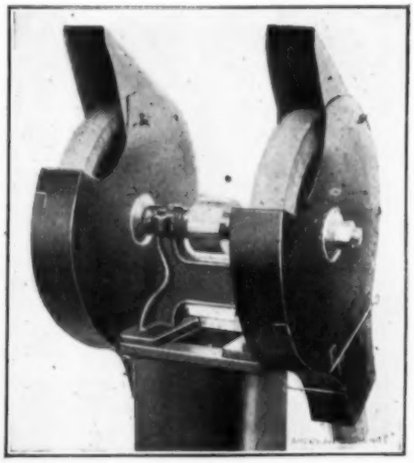


Fig. 16. Wheels for Polishing Shanks

above and dust guards are provided, which are connected to the exhaust system.

Fig. 17 is intended for grinding and

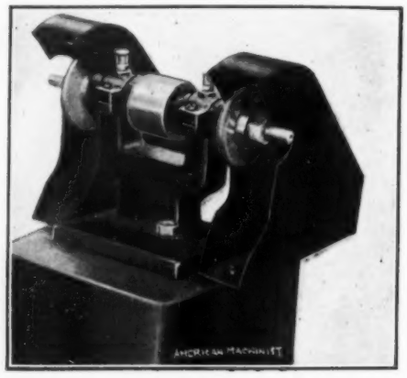


FIG. 17. GRINDER FOR POLISHING OUT FLUTES

polishing the flutes, and also has dust hoods to be connected to the exhaust system. It is mounted on a stand and is intended to be run by an overhead belt.

Choosing and Learning a Trade

BY C. A. ROGERS*

The problem of selecting a future means of livelihood is perhaps one of the most important that ever confronts a young man or his parents, and also one of the most difficult to solve. Educators have been working at it for years, and many ideas have been followed out, with a view of deciding it in the schools, but the public in general seem to give it little consideration. The plan generally is to send the boy to school, and then let him drop into the first seat he finds vacant.

After years of experience directing the labor of men and boys, and making this question a study, perhaps a few observations might not be altogether uninteresting.

One of the saddest spectacles I ever see, is a man with talent, ability and ambition, struggling along through life on about one-half the income he should have, and such conditions would seldom exist if the choosing of an occupation were made a study and reduced to a science as it should and will be. The reason most men fail to be efficient is because they are not in their right places.

Time after time I have had men employed as helpers, at a very small wage, who showed marked ability to do something far more profitable to themselves and others, and when given an opportunity were surprised at themselves.

A short time ago a man of about 35 made personal application for work. His speech and appearance indicated education and natural ability. In reply to the question of what kind of position he was seeking, he stated that he would be glad to work at most anything to start with. Noting my surprise, he stated that he was a preacher but that he was unable to make enough to live at it and wanted to try something else, thus throwing away years of study and much money fitting himself for an occupation he could not succeed at. At another time a young man of 20 was engaged as a helper. In a very short time he showed ability to do things mechanical, and asked to be given a chance to learn the business, as he stated he liked such work. He was very soon given the chance and is making good far above the average, and all this in spite of the fact that he had passed through a business college successfully. But as he explained, he did not like that kind of work.

CHOOSING AN OCCUPATION TOO YOUNG

I am fully satisfied the choosing of occupation is done too early in life. Only one out of eight who started in the business as apprentices stuck to it and succeeded; the others that were a success found out their mistake in time to save themselves by changing occupations. The old apprentice system has almost disappeared because it did not produce good enough mechanics to supply the demand and it was found that men a little older, who showed aptitude, would become efficient in much less time. And also because the boys were left more or less to their own resources, and to whatever promiscuous instruction they could get from the other men in the shop.

But the worst mistake of all is in starting a boy in to learn some particular line of work while he is yet a boy. It is almost a certainty that the boy will rarely want to do the same things when he becomes a man. The period of transition from boyhood to manhood is almost sure to change his likes and dislikes to such an extent that it is practically useless to begin training him for a position in life until this stage has passed, and if the reader will look over his own acquaintances he will discover this to be a fact. Boys will often show marked tendencies for certain things and then as soon as they are men they turn to something else or would like to if it were not too late.

The solution of this problem as I see it is: A boy's education should be so timed that he would leave high school at about the age of 18, then while the changes in his life are taking place, he should devote about three years to different kinds of work or study. Then by the time he is 21 he will have a pretty definite idea of what he wants to do. At this time he should enter a real training school, equipped with modern uptodate manufacturing appliances and instructors that instruct the student in the same way he will have to do when he enters the work commercially, or enters college, as the case may be. But the training school at least should be provided by the public. The objection might be raised that twenty is rather late to start what would be called apprenticeship, but after a little reflection this will disappear. The student who enters college at this age is at the age when man absorbs ideas fastest and easiest. And last but not least, with the proper instruction and equipment he will become proficient in about half the time he would under the old system.

The public school is not complete until it prepares the student not only for social life, but to enter any phase of commercial life fitted to follow his particular line of work with the highest efficiency. And it is a fact that the highest standard of workmanship, with the highest standard of remuneration, is the most profitable for the worker, the employer and the nation.

*Superintendent, Enamel Concrete Company.

Border Lines Lower Efficiency

BY F. D. BUFFUM

I think there is a chance here for our efficiency engineers, of whom we hear so much now-a-days, to save a few more cents by cutting out the use of border lines on detail drawings. The loss in them lies, not so much in the making of them, as in the space they waste.

It is true that a blueprint without border lines has sort of a bald-headed look, but for shop details I cannot see that this is of any importance. The waste comes in the space lost in the original tracing and in blueprints. If this space is of no value then it might better be omitted, the tracings made the same size as the inside of the border lines, and time and ink saved putting them in.

For instance, a tracing whose cutting dimensions are 24x36 and whose border lines reduce its effective area to 22x34 has 13 per cent. of waste surface. If it were trimmed off, at least storage space would be saved and it would be easier to get tracings into and out of drawers. But it would be better to omit the border lines and keep the sheet the present size, thus saving this 13 per cent. waste.

In America demand for a big output and cheap castings has developed in a number of lines of foundry practice to an extent not found in any other country. The green-sand mold is more universally used here and the variety of core binders exceeds that employed in any other country. At present probably the most common core binder used abroad is what is known as core gum, which is really dextrine, one of the products of the starch industry. Pea meal is also used abroad to a considerable extent and rye flour and linseed oil in certain foreign countries. America has been the first to introduce an extensive line of specially prepared binders.

Screw Machine Thread Attachment

By J. P. Brophy*

A device applied to the automatic screw machine for producing threads on screws and worms by means of a rotating cutter which is driven by gears from the spindle.

How the attachment is mounted upon the cross slide and given lateral and transverse movements for the feeding of the cutter to depth and across the work.

*Vice-president and general manager, Cleveland Automatic Machine Company.

The object of this attachment, shown from front and rear in Figs. 1 and 2, is to mill a thread as shown in Fig. 3, in combination with all other tools, thereby completing the piece in one operation. The thread, produced by the cutter, is five-pitch, right-hand, square thread, and the thread at the end is 20 pitch, right hand.

The attachment consists of cutter *A*, Fig. 4, mounted on a vertical spindle, which is driven by worm wheel *B* and worm *C*, worm *C* being part of a horizontal shaft which is driven from the live spindle of the machine by means of spur gears *D* and *E*. Gear *E* is keyed to the hood of the live spindle and is as much wider than gear *D* as is necessary to keep the full width of the face of gear *D* in contact, while the attachment is automatically moved horizontally.

The entire attachment is mounted on the front cross slide of a Cleveland plain automatic screw machine (without turret), this machine being fitted with double cross slides, and this part of the attachment, which carries the vertical spindle and cutter *A* is mounted on slide *F*, which moves parallel to the spindle of the machine.

In making this piece, the small threaded end is formed with a combination tool, cutting off and forming being simultaneous operations with tool *M*, Fig. 5. Then, after the bar is fed out to the stop gage and the chuck closed, the cutter *A* is fed straight into the bar to the required depth and the forming tool *L*, Fig. 5, forms the plain end of the piece while the worm is being milled.

When the front cross slide reaches its destination and the two operations above described are completed, it is fed along 3/16 inch in a direction parallel to the work by means of tool-stock spindle *H*, Fig. 4, the end of the lug *I* engaging collar *J*, which is attached to the slide carrying the cutter spindle. When the required length of thread is produced, the front cross slide, carrying the entire attachment, backs away from the work. Then, upon the return stroke of the tool spindle *H*, the lug *I* engages the collar *K* and returns the slide carrying the cutter spindle to its starting position.

When the center of gear *D* is exactly over the center of gear *E*, the cutter has reached its full depth in the work. As *E* is a fixed gear and *D* has a transverse movement, at the moment cutter *A* comes in contact with the work, *D* stands 1/8 back from the vertical position. This increases the distance between the centers *D* and *E* 0.004 inch, which has no particular effect on the working of the gears.

It will be noticed that there is sufficient distance between collars *J* and *K*, to make the engagement between the tool-stock spindle and the cutter slide absolutely safe, as the moment the main cross slide of the machine advances and brings the stud, upon which are collars *J* and *K*, forward into working position, the lug *I* is in a position about half way between collars *J* and *K*. This gives plenty of leeway to compensate for any off position of either cutter slide or tool-stock spindle.

The vertical spindle carrying cutter *A* and the worm wheel *B* may be removed from the attachment in order to permit the cutter to be ground. The sharpening of the cutter is accomplished by grinding the top face, which is always on a center line with the spindle of the machine, a nut *G* being provided underneath the cutter to take up the difference in thickness, as the cutter becomes thinner with grinding.

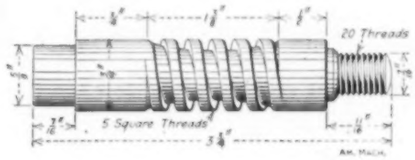


FIG. 3. THE PIECE TO BE THREADED

Cutter *A* revolves at all times and works on the principle of a hob, and being geared positively to the live spindle of the machine, it may be fed along the work at any rate it will stand, and will always be in time with the thread being produced on the work, on account of the fact that the worm gear *B* and worm *C* are exactly the same size and pitch of thread as the cutter and the work, and whatever position one takes, the other must follow.

If the thread produced was parallel a greater distance than 3/16 inch (say 1 inch), it could be produced just as satisfactorily, and the cam that moves slide *F* horizontally does not necessarily have

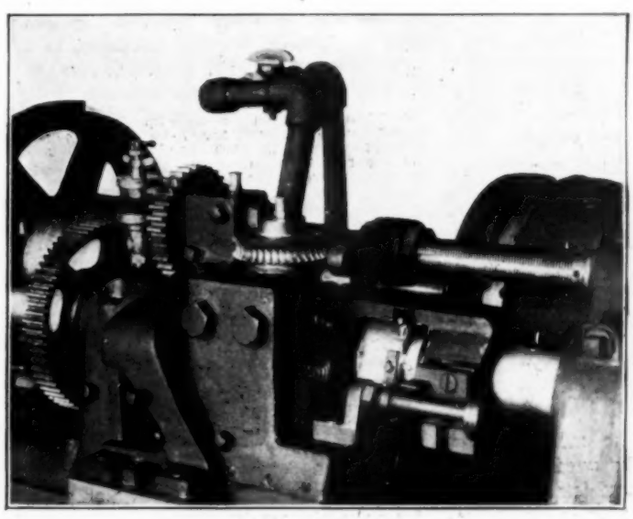


FIG. 1. ATTACHMENT FOR CUTTING SQUARE THREADS AND WORMS ON THE AUTOMATIC SCREW MACHINE

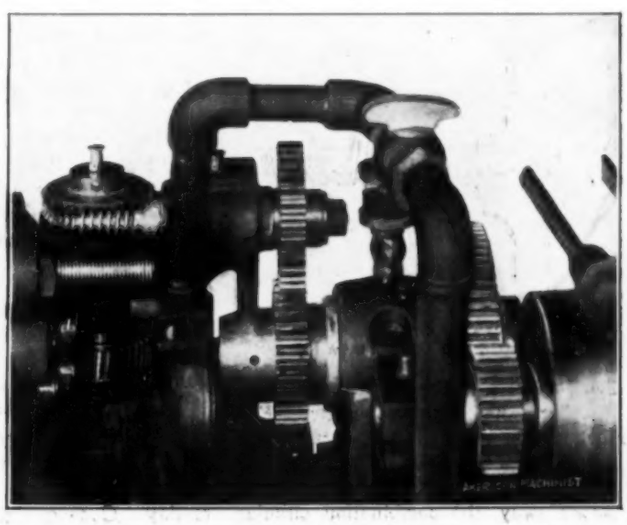


FIG. 2.

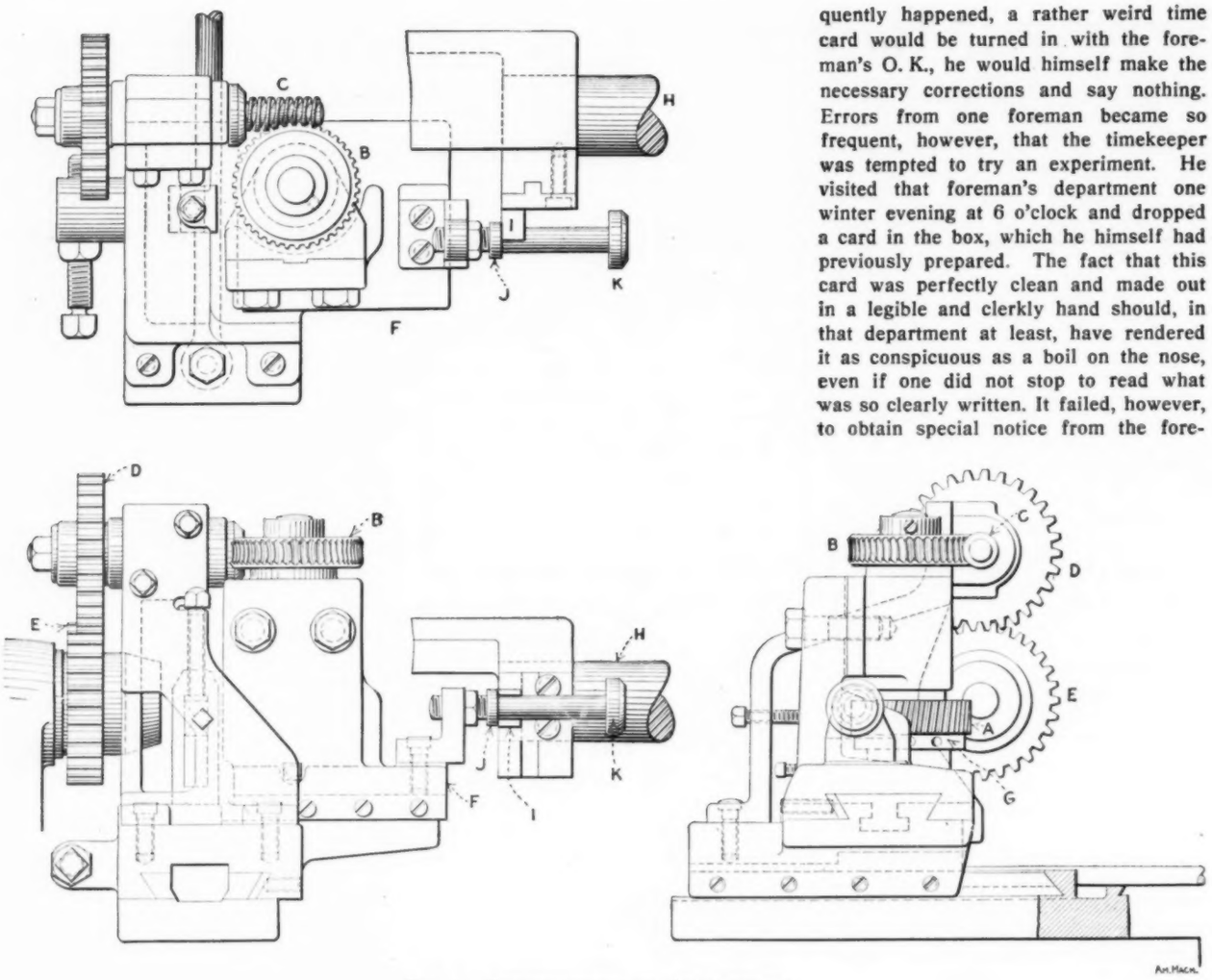


FIG. 4. CONSTRUCTION OF ATTACHMENT

to be exact in any way. If the cam were somewhat irregular on its surface at the working point, owing to the whole mechanism being in time the thread could be produced just as accurately and could be made parallel up to a length where the bar would spring away from the cutter to an extent not permitting of a parallel thread.

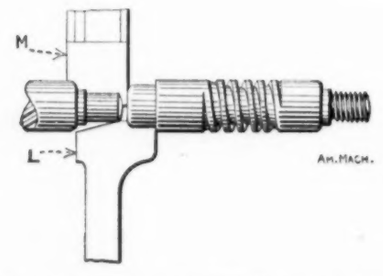


FIG. 5. CUTTING-OFF AND FORMING TOOL

The outer end of the work is supported by a roller rest for these operations. The self-opening die, which is mounted in the tool spindle, then advances and cuts the fine thread in the end of the work, and as it backs away, the combination circular forming and cut-off tool, mounted on the rear slide, immediately starts to cut off the finished piece and form down the end of another, the work being produced complete at the rate of 40 pieces per hour.

A Time Card

BY H. M. PHILLIPS

The foremen at the old A. & B. plant were expected to earn their pay, and lest they might not have time to do so between 7 and 6 o'clock it was made a part of their duty to check up all of the time cards of the men in their departments after the latter hour, no small job for one who had 40 or 50 men working on a multitude of different jobs. Some of the men, however, got through the job with astounding rapidity.

The timekeeper was a man who could appreciate the feelings of a hungry foreman with a stack of poorly executed time cards before him, and he had, moreover, an almost miraculous knowledge of what each man in the plant was doing from day to day. Consequently, when, as it frequently happened, a rather weird time card would be turned in with the foreman's O. K., he would himself make the necessary corrections and say nothing. Errors from one foreman became so frequent, however, that the timekeeper was tempted to try an experiment. He visited that foreman's department one winter evening at 6 o'clock and dropped a card in the box, which he himself had previously prepared. The fact that this card was perfectly clean and made out in a legible and clerkly hand should, in that department at least, have rendered it as conspicuous as a boil on the nose, even if one did not stop to read what was so clearly written. It failed, however, to obtain special notice from the foreman. Consequently, the timekeeper was able to visit the department again the following morning and ask the foreman if he did not want to make any corrections, although a part, if not all of the statement he had signed was undoubtedly accurate. The laughter and the jokes that lasted for many a day from the few that were informed of the circumstances, kept that foreman in line, perhaps even to the present day. Here is the card:

Chck No. 4-11-44 *Date.* July 4, 1776.
Department. Kindergarten. *Name.* Timekeeper.
Order Numbers: Give number of hours on each.
I do not think that you look over your time cards very carefully.
Total Number of Hours. 144
Approved,
John Smith,
Foreman.

The Department of Industrial Research of the University of Pittsburgh, under the direction of Professor Robert Kennedy Duncan, is undertaking a scientific study of the soft-smoke problem in its various phases. This study will extend over a period of at least two years, and as much longer as is deemed necessary to accomplish the end in view. The research is undertaken under conditions which promise valuable results.

Gaging Surfaces by Electrical Contact

By George J. Murdock

To ascertain the truth of a plane surface by the use of the common surface gage is very trying, especially in dark weather or when there is an overhanging projection so close to the surface plate that it is impossible to look underneath. In constructing jigs this difficulty is particularly notable. As often met with it will occur where the needle of the surface gage may be introduced, but the space is so small that the hand cannot be inserted to tap the needle. Under such circumstances it is extremely perplexing to judge with any degree of accuracy to what extent the bushing or other part may be wrong. It is one of the functions of the surface gage to act as a detector of work that is not accurate when compared with that which is known to be right, but the conclusions derived from its use must be certain in order to be of value.

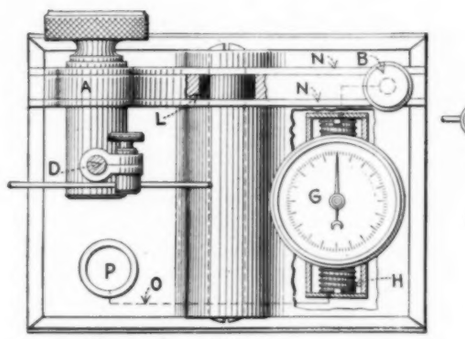


Fig. 1

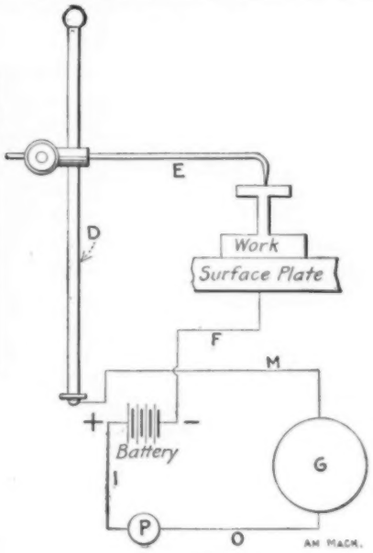


Fig. 2

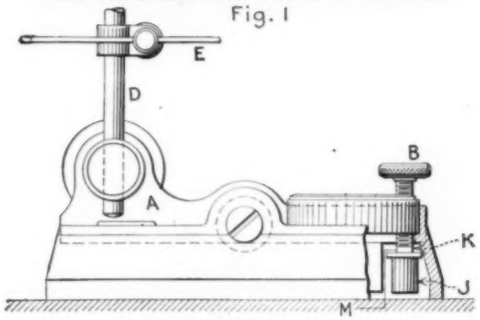


Fig. 3

Diagram of Parts and Connection for Surface Gage with Galvanometer

Construction of the Gage

Having met some of the difficult conditions mentioned, I designed some years ago and have used since with satisfaction the electric gage shown herewith. Fig. 1 is a plan view of the base of the instrument, and a portion of the electrical connections. The bottom is recessed to receive a rectangular battery cell of the type used in pocket searchlights. It is bored out on the rear end at the top to hold a small galvanometer *G*, which for this purpose was made from a pocket compass. A helix *H* of finest, silk-covered, resistance wire wound on a boxwood spool is located beneath the compass and at right angles to the axis of the needle, which will always point toward the swell on top of the base made to accommodate the trunnion screws on which the fine adjustment lever *A* swings.

The recess in which the compass stands is bored entirely through, only a narrow ledge being left for the case to stand on. This is rendered necessary by the tendency of the needle to dip toward the mass of iron beneath it, which interferes with its free oscillation. As the attraction on the bottom is removed the north-pole end will point toward the swell on the base and remain in very stable equilibrium unless a current is passed through the helix, when it suffers violent disturbance and will immediately place itself parallel with the axis thereof. Another hole is bored in the front of the base and a push button *P* forced in flush with the top. The fine adjustment lever *A* is insulated from the base by the hard-rubber liners *N N* and fiber bushings *L* and *J* (Fig. 3). Under the spring at the opposite end is a strip of fiber so that the lever is completely insulated.

The Complete Electric Circuit

Fig. 2 illustrates by diagram the complete electric circuit. It will be seen that one terminal of the battery cell, say the positive, is connected to one terminal of the push button which is insulated from the base. From thence it is led by the wire *O* (incased in small, soft-rubber tubing) to the No. 1 terminal of the helix *H*, which has a resistance of about 150 ohms. From the No. 2 terminal it passes by the wire *M* to a small brass pin K, (Fig. 3), which is located in the top of the insulating bushing *J*. It may now be followed in Fig. 2 through the lever *A*, which corresponds electrically to the wire *M*, needle bar *D*, and needle *E*. If the latter is in contact with the work the circuit is completed.

The other terminal of the battery is grounded through the wire *F* on the base, or its equivalent, the surface plate.

It should be borne in mind that the resistance of the helix *H* is high, therefore with ordinary use the battery lasts a long time, and as the cell only gives a fraction of a volt it is impossible to distinguish a spark even in a dark room when the needle point *E* leaves the work, thus breaking the circuit. Yet the current is strong enough to produce a violent fluctuation of the galvanometer needle under all circumstances. The battery cannot be run down accidentally as the circuit is always open unless closed by the push button, even when the gage needle is in contact with the work. So long as any energy is left in the cell the galvanometer will show in an unmistakable manner when the button is pushed whether or not the gage needle is in actual contact.

Fig. 4. A Complete Surface Gage

It is surprising to note how many times it is found not touching the work when by all the usual tests the needle point is thought to be in contact. In any place otherwise inaccessible where the gage needle can be introduced it will show at once whether the point is approximately or really in contact. It has been my practice in using this gage to obtain a position as close to the surface as possible with the usual procedure, before attempting to use the electric contact. Closer relations were then obtained by bringing into use the galvanometer.

Fig. 4 shows the instrument to be simple and attractive in appearance. The electrical combination in no way interferes with, nor detracts from, the use of the surface gage for ordinary work.

Selection and Compounding of Cores

By Henry M. Lane

The selection of the proper materials with regard to the product being manufactured and the local conditions as to the supply of core-forming materials.

*Extracts from a paper presented before the American Society of Mechanical Engineers.

Cores for Steel Foundry Work

The selection of the proper materials for use in any given core room depends upon local conditions as to the supply of core-forming materials and the product being manufactured. A wider variety of materials can be used in connection with gray-iron work than in most other classes of work.

Heavy open-hearth steel work requires the best materials. Both the mold and the cores must be made of silica sand and nothing that has a tendency to fuse at low temperatures can be employed. At the same time the cores must be of such a nature that they will crush readily before the metal as it shrinks. This has brought into use many different mixtures all having the same object in view. Flour or flour and molasses are sometimes used as binders and the cores baked until the bond is practically destroyed so that the core is rotten. Core arbors and core rods are relied on to hold the material together and the surface is thickly coated with a silica wash which gives a strong skin to the core. Such a core will usually resist the action of the molten metal and crush readily when the casting shrinks.

Othrs use both clay and sawdust in their core mixtures, the sawdust burning out and allowing for shrinkage and the clay acting as a binder. The burning of the sawdust frees the clay and permits the cleaning of the core. In one light-work steel foundry shop a core made of silica sand, Welsh mountain clay and sawdust is used, the core being baked until the sawdust is partially charred.

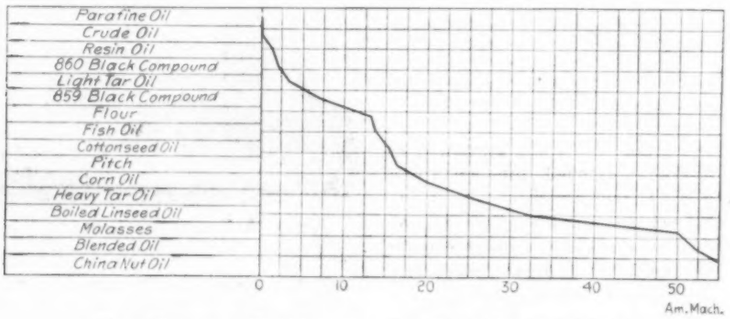
For work with core mixtures in which a binder like glutrin will sweat to the surface such a mixture could be developed to good advantage for steel-foundry work, as a core of this kind has a hard skin and a rotten or soft interior. All such cores, however, have to be baked carefully at a certain temperature for if the skin is burned there is nothing left of the core. Glutrin is used in steel-facing sand and in many clay and silica sand core mixtures.

Cores for Brass, Bronze and Aluminum

The other extreme in the core field is found in the brass and bronze foundry. Here the temperatures encountered by the cores are much lower, and greater diversity of sands and binders can be employed. In a case of this kind what is needed is a core with a close surface which is still free venting enough to permit the mold to be filled quickly and the gases to escape readily.

Clay is out of place as a binder in brass and bronze work and the material used should be of such a nature as to burn out at a rather low temperature.

In dealing with aluminum a metal with maximum shrinkage and minimum hot strength is encountered. This requires a core that yields readily and softens as quickly as the metal strikes it. Two courses are open: to use a mixture giving a core with a soft interior and practically all the binder on the surface so that as quickly as the surface is disintegrated the core can be readily crushed; or to use a binding material which softens as soon as heat strikes it whether it burns or not. Resin is the only binder which fully meets this latter requirement, and it is frequently used to good advantage in aluminum work. These cores clean out readily if the castings are taken from the mold hot and cleaned out at once, but if they are allowed to get cool the resin cores harden once more and it is almost impossible to get them out.



The Relative Strengths of a Number of Binders

Cores for Gray Iron and Malleable Iron

For gray iron or malleable work the core problems to be met are almost infinite. In the radiator shops and in stove foundries producing gas range burners it is necessary to have cores which are exceedingly strong and free-venting and which will stand being entirely surrounded by metal with the exception of a small print. This means a core made from sharp sand and at present all such are of oil or mixtures of oil and glutrin as binders.

Oil-sand cores have one advantage possessed by few other binders, that a core made from clean sand and oil has no tendency to absorb moisture and can be kept without losing strength for an indefinite length of time. The writer has cores in his possession, now nearly five years old, made of linseed oil and clean sand, some of which were used after they were four years old and seemed to give as good results as the new ones.

A core for the most exacting requirements met by oil-sand mixtures must have a tensile strength of at least 75 pounds per square inch. In such mixtures it is usually the most economical to employ only high-grade materials and particular care must be taken to see that the sand contains no loam which will destroy the bonding value of the oil. Linseed oil at $1 per gallon as it has been this past year, makes the cost of the old standard binder almost prohibitive and has led foundrymen to look for cheaper materials. All of the paint and varnish oils, including China wood, Soya bean, corn and cottonseed oils have found a place in the core-oil trade. The regular blended oils on the market also carry resin and neutral oil. As a rule the neutral oil does not add appreciably to the binding power of the compound but it does serve to carry the resin into the mixture and to give a waterproof oil of sufficient strength for ordinary work at a much lower cost per gallon than the old standby, linseed. As linseed oil, however, is the ultimate standard of excellence for all core oils, some firms prefer to use it and either to dilute it themselves or to use glutrin in the mixture with it. In many gray-iron and malleable foundries flour or dextrine is used as a binder and for some classes of work they give entire satisfaction.

The phenomenal development of the Diesel engine is probably one of the most impressive engineering features in Europe. This is now seen everywhere, in hotels, department stores, factories and power plants. It is much more common than any other recent type of engine.

The Natural Law of Work*

By Hermann Schneider†

From the laws of physical labor all work is either energizing or enervating. If the former there follows an exercise of initiative, mental development, contentment, high moral tone, regard for civic duties and production of good quality and in good quantity. The individual is fully developed.

If the work is enervating the reverse is true.

A few examples showing an increase in the percentage of energizing work by an application of the principles of the law of work.

NOTE—This material was originally prepared as a chapter for a book of Lecture Notes on Some of the Business Practice of Engineering by Dr. Alex. C. Humphreys.

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In medicine there are two types of doctors. One treats superficial symptoms, the other first searches for the basic cause and then prescribes. The first kind gives a headache powder; the second finds the functional disorder which causes the headache and works to remove it permanently. In the long run the first doctor weakens the resisting power of his patient, while the second strengthens it.

We are paralleling this in our treatment of industrial ills. When there is a general or a particular industrial breakdown we want immediate relief and take the headache-powder cure. Ills in the form of labor troubles, profit killing, foreign competition, inadequately skilled artisans, large groups of workers constantly shifting and drifting aimlessly from one occupation to another, an increasing feeling of centrifugal tension where solidarity should exist—these are pressing more urgently day by day. In response to the need there have arisen in rapidly increasing numbers doctors of industry, both skilled and quack. They are generally specialists, one for the head, another for the heart, another for the stomach. The body politic is being treated by each of them independently.

The ills are all ills that grow out of work. They are not a mysterious, wasting-away, visitations of Providence, fits brewed by the powers of darkness, or something that runs in the family, any more than headache is. The causes are real and lie within the realm of natural science. Therefore, the logical starting point of a diagnosis must be to ascertain the natural laws of work, nonconformity to which causes our industrial headaches.

Now there is a natural law of labor which operates as surely as the law of gravity.

It can be shown by history that a people who will not work will fall to swift decay.

The substance of the law of labor is: Work and you will reach a higher mental development; cease work and you will degenerate. The law applies to individuals, to communities, to nations and to civilizations.

As a compelling prod to drive humanity to save itself, there is another natural law, which needs no proof. Simply stated, it is *work or starve*.

Work is effort put forth to satisfy needs. We work because we have to. There is an instinct for work, but basically it is the instinct for self-preservation and self-perpetuation. All that is best in the history of civilization has come from work, all that is worst from idleness and the consequent sins of idleness. Mentality is the result of physical activity and in turn stimulates it.

Now of all the products of the labor of the centuries there is probably none to which we of this generation look with more satisfaction than to our scientific achievement and our mechanical ingenuity. Yet these two distinguishing elements of our modern civilization have set up barriers to the realization, by the majority of workers, of the greatest benefit of work, namely, mental development. For they have wrought significant changes in the conditions of work.

CHANGES IN CONDITIONS OF WORK DUE TO OUR INDUSTRIAL ACHIEVEMENTS

In the first place, *it is only within the past two generations that mankind has worked in masses within walls.* For centuries men did individual, self-directed work almost entirely in the open. The change has come through the development of power devices, and dates virtually from the invention of the steam engine.

In the second place, the industrial worker formerly knew a *whole* job, rather than a part of it. He performed a great variety of functions in the completion of his task, instead of endlessly repeating the same operation. The clockmaker made a *whole* clock, working individually, and the necessity of working out every part's relation to every other part gave him a mental stimulus, and, therefore, a higher mental development. The finished product was all his own; the desire for self-expression which every man has, found an outlet through his work. Once having served his thorough apprenticeship, he worked largely by self-direction.

Under our present, highly organized, industrial conditions, the making of a clock is subdivided into a large number of operations. Each workman in a clock factory makes piece after piece of the same kind, principally by feeding material into a machine. Why he does it he need not know and usually is not told. We are putting the brains into the machine and into the management office.

It is unquestionable that much of the present spirit of industrial unrest is nature's protest against work without light, physical and mental. It is this purely automatic, high-pressure work in closely crowded rooms, which is the most ominous feature of modern ndustrialism. Its most serious aspect is the effect upon mental development. Scientific research has shown us that the monotonous, rhythmic repetitions of the machine's motion and the monotonous, rhythmic motion of feeding the machine, produce a hypnotic deadening influence on the mind. The lower brain centers, controlling habits, are developed at the expense of the higher thinking centers. Research further shows that the higher centers in the brain of such a worker are in danger of getting into a permanent, inelastic, hopeless set, if a lively stimulus is not supplied.

Further, there is in every individual a desire for self-expression. If this cannot be had in one's daily work, nature will force an outlet for it. It cannot be dammed up very long. Since there is no outlet in the worker's daily task it must come during his idle hours, and sometimes takes a form which leads to many of our most vexing sociological problems.

ENERGIZING WORK IS DECREASING—ENERVATING WORK INCREASING

The situation sifts down to this: Energizing work is decreasing; enervating work is increasing. In spite of the warnings of history, we are rapidly dividing mankind into a staff of mental workers and an army of purely physical workers. The physical workers are becoming more and more automatic, with the sure result that their minds are becoming more and more lethargic. The work itself is not character building; on the contrary it is repressive. When self-expression comes, it is hardly energizing mentally. The real menace lies in the fact that in a self-governing indus-

trial community the minds of the majority are in danger of becoming atrophied, or at best of becoming trifling and superficial because of lack of continuous exercise in conjunction with the earning of a livelihood.

The kind of citizenship that a republic needs cannot be built on 60 hours per week of automatic work.

But we cannot reverse our present economic order of things. Automatic work is increasing and will continue to increase for a long time to come. The condition is here and philosophical discussion will not remove it.

Division of the Law of Physical Labor

It is evident then that the law of physical labor must be divided into two laws, namely, the *law of energizing work* which makes for progress, and the *law of enervating work* which makes for retrogression. Nearly all the work still done in the open air, where there is a dependent sequence of operation, involving planning on the part of the worker is energizing work. Specific examples may be cited in farm work, railroad work and the building trades. Certain work done indoors, under good conditions of light and air, is also energizing. For example, the work of a toolmaker, a locomotive assembler and a cabinetmaker. The enervating work has come through the subdivision of labor in factories, so that each worker does one thing over and over in the smallest number of cubic feet of space. This type is recognizable at once in the routine garment worker, the punch-press operator, the paper-box maker, the shoe worker, etc.

Aside from the broader factors, such as climatic conditions and racial characteristics, it is safe to say that the morale of a community depends upon the kind of work it does.

A rural community of about 12,000 people, having clean political conditions, a high moral tone, few jarring families, well kept gardens and a good average of intelligence, is, from the manufacturer's viewpoint, a desirable place in which to locate a factory. If a manufacturer locates in such a place and employs 3000 of the men, women and children in purely automatic, noisy, high-speed work, the town will change very materially in one generation. Its politics will become corrupt and its morals lax, its citizenship will lose its former mental stability and fly eagerly and earnestly from one spectacular "ism" to another, its families will be on nervous edge with family discipline gone, its yards and houses will lose their tidiness, saloons will increase. In a word, it will become "a factory town."

What was once a good community with a high community efficiency, and, therefore, a safe place in which to invest money, becomes a town of low community efficiency and a constant menace to the industry itself. Every detail of the town's life is affected. Religion lags, while the amusement parks thrive on Sunday; for since the week-day work is repressive an outlet for pronounced self-expression is demanded in the idle hours. Or, to put it another way, nature goes on the defensive. The slowly upbuilt appreciation of the fine arts is quickly destroyed, for this cannot grow without harmony, orderly thought, and the desire to express ideals. Respect for law diminishes, for the law is put in the same class as an electrically wired strike fence. These significant changes are not the fault of the people who work; they are logical, natural products of the work itself.

Scales of Energizing and Enervating Work

For the purpose of analyzing work, a scale has been devised in which the most energizing work is at the 100 per cent. point, and the most enervating at the zero point. The 100 per cent. work is that of the locomotive engineer. This has been selected because his work has the following elements:

(a) It is done in the open air.

(b) It provides a well rounded physical development.

(c) The constant improvements in locomotive design and railway appliances generally require continuous mental development.

(d) Mental alertness is constantly required for emergencies.

(e) A comprehensive grasp of the whole interdependent scheme of production (a railroad produces transportation) is essential.

(f) The conditions under which the same run is made are never alike.

(g) The work itself—not lectures, nor preachments, nor popular acclaim—breeds in the engineer the highest quality of good citizenship, namely, an instant willingness to sacrifice himself for the lives in the train behind him.

The zero point on the scale, or the most enervating work, is the work during her formative years of a girl in a steam laundry, when the following elements prevail:

(a) Supersaturated, hot, vitiated air.

(b) Standing in a strained position.

(c) The work consisting of feeding one piece after another of the same kind at high speed into a machine.

(d) The hours of work being so long that fatigue poisons accumulate.

The scale is crude and lacks scientific accuracy. A statement, for example, that the work of a laster in a shoe factory is 40 per cent. energizing would be a guess. But the purpose of the scale is not so much to arrive at a percentage as to establish some standard of actual work for the purpose of diagnosis and treatment. Three investigators, analyzing the work of a laster, might classify it as 30, 40 and 50 per cent. energizing. The difference in their classifications would lead to a closer analysis and hence to a surer treatment.

A Silk-mill Example

To take a specific analysis, consider two adjoining sheds of a silk mill. Going first to mill A you find a long room with an aisle down the center, on each side of which are the machines. Between the machines there is ample space for the operative (nearly always a girl) to go up and down tieing the broken threads. In the main aisle and adjacent to each machine is a chair. When the girl has finished one round of her machines she rests for a short period, and in this way fatigue is prevented. The two girls of adjoining machines usually time their rounds, so that their rests come simultaneously. The noise in the mill is so slight that they can converse without any effort. In the center of the room in the main aisle is a wash stand at which there are usually about six girls, cleaning gum from their hands. The light is good, the air is not vitiated, the rest periods are sufficient, there is no nervous tension from noise or speed, the work is not monotonously automatic, the position of the body is not strained, but on the contrary, many muscles are lightly brought into play. However, the work itself does not stimulate any mental activity nor develop any of the finer and higher mental qualities. It can be classed as about 70 per cent. energizing.

The silk after leaving this mill is sent to mill B, where a number of strands are woven into a single strong strand. Since the silk is now strengthened the machine can be run at a higher speed. On entering mill B you are confronted with a noise so great that talking is entirely out of the question. The layout at mill B is precisely the same as at mill A, except that there are no chairs in the aisle. There are no rests between the rounds which the operator makes of the machines, since the speed does not permit. Talking is utterly impossible because of the noise.

This mill is at once diagnosed as the sore spot of the concern. The investigator is enabled to say to the owner: "This is your trouble center; here is where agitation begins. More operatives leave this mill per year than leave mill A. These workers are suspicious of each other's actions, particularly of the foreman's. They feel that you are their natural enemy. The foreman himself is a grouch. More jarring families, more unkept back yards are represented here than in mill A, and finally the actual efficiency of this mill is no higher than in mill A, and the work is more strenuous."

The work is classified as low as 10 per cent., yet the only difference between

the two mills is in noise, speed and lack of rest. The noise is a mechanical engineer's problem, possible of solution. The speed and the fatigue are within the owner's control. With these three factors eliminated, the work would go up to 70 per cent. energizing. As much work would be produced under the better conditions, since the force could be kept as intact in mill B as in mill A.

Two Treatments

Two doctors of industry would treat mill B in opposite ways. In order to increase the production, one would increase speed, ignore the noise, study the motions to eliminate waste moments, and by the unanswerable argument of figures show you that production must go up. This is the headache-powder method and leads to a constantly broken, shifting, dissatisfied working force.

The second doctor would decrease the speed, cut down the noise, insist on carefully determined rest periods, and thereby maintain a sound organization of skilled workers. He would raise the general efficiency and hence the economic efficiency of the community. Nor would he stop at that, for he would further strive by known methods to introduce additional conditions, so that the work in both mills would be brought to about 80 per cent., which would probably be the limit for this class of work.

Value of Conversation

It should be noted that where the work is done under conditions which permit the operatives to talk without interference to their work, the rating is much higher than where such is not the case. When we walk our habit cells control the action, but we can walk and think at the same time. The same principle holds in automatic occupations. If the motions are not too rhythmic, both of hand and machine, and conversation is permitted and encouraged the work is not nearly so repressive.

In a certain mill employing girls at strictly automatic work the employees were placed facing one way, so that one operative looked upon the back of another; between adjacent operatives was a small partition. This mill had to replenish its entire force each year, until the scheme was changed to a round-table plan which encouraged conversation. After this the losses were normal.

An Interesting Case

An interesting case of shop psychology is the following: In a certain piano factory, a number of girls were employed to assemble the mechanism which transmits the action to the strings when the key is struck. Each girl attached a piece with a limited number of motions and was paid on the piece-work plan. These employees were the most discontented in the firm, and were constantly shifting to other occupations. Various means, such as rest rooms and decorated surroundings, were tried without success.

As a last resort the foreman got a fine big maltese cat and placed it in the room one morning before the girls arrived. This solved the trouble completely. The cat compelled rest periods, for every now and then it would jump into a girl's lap and take her attention from her work for a few moments. In this way the tension of the high speed was relieved, permitting the elimination of fatigue poisons at irregular but sufficient intervals. Every girl planned at home to bring something in her lunch basket for the cat to eat, whereas attempts to get them interested in the decorating of rooms failed. When girls left this firm and went elsewhere, where there was no cat, they quickly returned. Production increased and peace reigned. The commercializing of a woman's home instinct for a cat, probably energized the work 10 per cent.

It was found also that the introduction of the cat began to arouse an interest in the other betterment plans which had originally failed. This particular case is worthy of a very careful psychological analysis.

The details just stated are cited not so much to show specific methods of procedure, as to emphasize the basic fact that we are, individually and collectively—human units, towns, states and as a nation—what our work makes us.

The Knack of Explaining

By S. N. Bacon

A draftsman or toolmaker engaged in the design of tools, fixtures, etc., often wonders why his work is turned down by the chief draftsman or superintendent while a fellow workman easily puts through an inferior design. The suggestions which I wish to give apply more to the draftsman than to the toolmaker because his work is represented by a mass of lines the meaning of which must be thoroughly explained, while the designing toolmaker or experimental man has a partly finished tool or model to demonstrate with.

The error which a good many efficient engineers make is this: they forget the fact that while designing the special machine or other device that required maybe a month to draw, they become thoroughly familiar with every line, but to the superintendent, even though he is a draftsman, it will mean only a cobweb of lines until he has studied the drawing, being aided by short, brief explanations from the draftsman. Now the majority of draftsmen never put any study on this branch of their profession, being satisfied to hear others explain, but this knack of explaining would be a valuable asset to the engineer's education.

There are few superintendents who are going to admit that they can't understand what you have shown on your drawing, and you never know why your work has been turned down. An engineer who gets his ideas in spasms (most good ideas come in a hurry) usually hurries to his superior and attempts to outline the scheme before he himself has thought out the details, but after having some valuable ideas turned down he gets wise and keeps things to himself until he has thought out a good explanation. Then he makes clear sketches or drawings of the present method, showing its faults, and also sketches to bring out clearly his improved method; at the same time his explanations are thought out and worded so as to bring the advantages of his improved device into the foreground.

Several times I have witnessed two kinds of draftsmen at work, one a really capable workman without confidence in his ability and no knowledge of how to explain and the other with a limited experience but unlimited enthusiasm. The latter thinks he is better than he really is, and thoroughly enjoys talking about his work. When he explains his design to the boss he makes it interesting, starts with the center lines and goes through all the movements, bringing out all the points, cheapness to build, strength, simpleness, etc. Now I am not referring to the bluffer, but to the draftsman who realizes the importance of explaining his drawings further than shown by the line. Of the fellow who cannot explain his work we usually judge that he does not understand thoroughly what he is trying to build.

We do not all possess the ability to explain things, but it is a knowledge which can be acquired. Constant reading of mechanical papers and patent journals shows one how valuable explanations can be made in a few words. We read in a technical paper how "lever *A* operates on cam *B*," etc. This is the stuff that teaches us how to describe things thoroughly and briefly.

A series of observations of the proper area of the core room, extending over about 15 years, has shown that the core room varies in area from 10 to over 50 per cent. of the molding floor. This includes the space occupied by the ovens and core storage, but not the core-sand storage. In very heavy gray-iron work, such as large Corliss-engine cylinders, heavy machine-tool castings, large forging machines, etc., the space devoted to core making may be equal to at least 60 per cent. of the active molding-floor space, but in this kind of heavy work about half is usually inactive, because heavy castings must be left in the sand several days to cool, hence the area as compared with the molding floor is about 30 per cent. of the total.

Planer for Sliding Gear Shafts for Automobiles

By Edmond Leymarie

The halftone, Fig. 1, shows the traversing head of a special automatic planing machine built by Lubin & Weiffenbach, Clichy, France.

This machine is intended for the production of accurate externally splined sliding gear shafts for automobiles. A

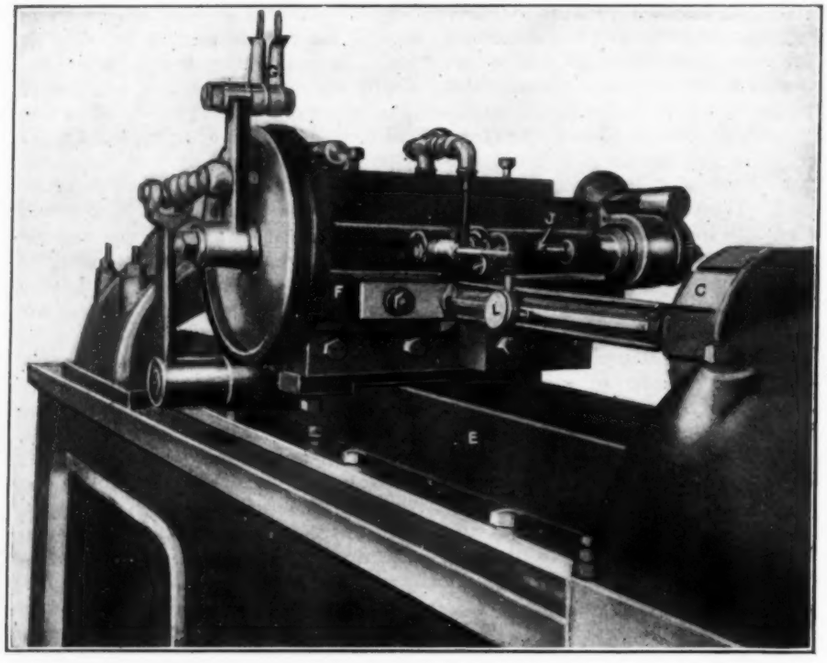


Fig. 1. A Planer for Sliding Gear Shafts

section of one of these shafts and the two tools used in the machine are shown in the line cut, Fig. 2.

The machine consists of a bed, upon which are two heads. One of these is fixed and carries a large division plate, giving divisions of 4, 6 and 8. The spindle is provided with a chuck *C* for holding the work. The movable head is provided with a center for supporting the end of the work.

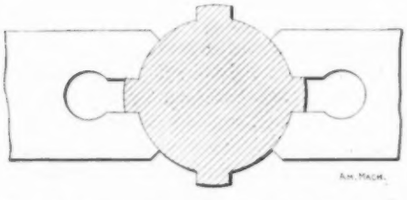


Fig. 2. Section of the Work and the Cutters

On the bed between the two heads is a carriage which carries the planing heads *F* These heads are located one on each side of the shaft to be splined and each one carries a formed tool as shown in Fig. 2. Automatic feed is provided for the heads and is controlled by the pawl *G*. The tools lift automatically on the return stroke. At each return of the carriage the work is automatically indexed before the tools are brought into cutting position. A micrometer stop *J* arrests the feed when it has reached the proper depth. The tools are simple in form and are ground to shape after hardening.

The machine is entirely automatic in its operation. A shaft 1¾ inches diameter 12 inches long of semi-hard steel with 6 projections can be planed in 20 minutes. The machine will take work 39 inches long, 2¾ inches diameter and will cut external splines 22 inches long. There are three cutting speeds and a comparator *L* is used to test the accuracy of the work and assist in adjusting the machine.

Cast Iron vs. Pressed Steel Shafting Hangers

By Robert E. Newcomb*

Some months ago it became my duty to purchase and install considerable shafting in connection with a new plant about to be equipped. A low first cost was a prime consideration; yet efficiency and low cost of maintenance could not be sacrificed.

Many of the millwrights of local textile and paper mills and mill-supply houses were consulted. A summary of reasons in favor of the two types of hangers follows:

Cast Iron—It is generally of rigid design, does not spring, and the threaded holes for adjusting screws are of ample length and size.

Pressed Steel—It is light, unbreakable, and claimed to be more rigid by those favoring its use. It is also a very little cheaper than the cast-iron hanger.

The above information left us at sea as to the best hanger to install; hence practical tests were made to determine the relative merits of cast-iron and pressed-steel hangers.

Well known makes of both cast-iron and pressed-steel hangers were selected as being the best of their type. Two hangers of a kind were installed on the main line of shafting driving woodworking machinery. They were so placed that the service on all hangers was alike. Great care was taken to have shafting properly alined and hanger loads properly and evenly distributed.

Close observation showed that the steel hangers sprung to some extent, while the cast-iron hangers appeared to be perfectly rigid. It was also observed that during the time of test, the steel hanger bearing showed greater evidence of wear than did the cast-iron hanger.

During the progress of the above test, much dismantled transmission equipment was examined and showed that, in service, steel hangers break more readily than cast-iron hangers, because the metal is crimped and oftentimes ruptured in the process of manufacture at points shown in sketch.

The manufacturer of steel hangers is evidently between two evils. If he makes the hanger of a light gage of sheet steel, it lacks rigidity; if the hanger is made of a heavy-gage steel, the metal is stretched, crimped and possibly ruptured at the sharp bends near the feet. Further objection to the steel hangers examined is that the threaded holes for the adjusting screws are not sufficiently long, and will stretch.

Cast-iron hangers were finally selected as being more rigid and durable, and because shafting boxes wear less. Shafting is more easily kept in alinement so that less horsepower is lost in friction. Babbitted boxes were selected in preference to ball or roller bearings as all were small motor drives; so that the shafting was easily kept in line. There was no excessive bearing pressures, and friction was reduced to a minimum.

*Assistant superintendent, Deane Steam Steam Pump Company.

One of the things that worries a man who is thinking of grinding his work is the wear of the wheel. He knows that all things wear and he naturally expects this to show on the diameter of a long shaft. But he quite forgets the wear of a lathe tool in turning up the same shaft. And there will be several times the wear to the tool that will be to the grinding wheel in doing this work. You can prove this on any long grinding job in the shop.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Cutting Right and Left Hand Screws Simultaneously on the Boring Mill

A short time ago, I had some heater sections to machine, which required to be threaded 4-inch pipe thread, right and left hand.

The full length of each section was about six feet. One end is shown at Fig. 1.

At Fig. 2 is shown the arrangement I made for doing the job on the horizontal boring machine. The work *A*, which was clamped by the usual methods, is shown in position on the machine table *B*. The

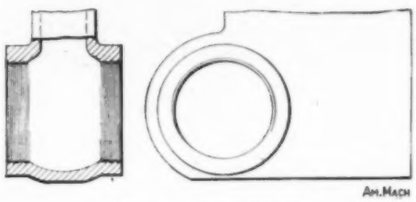


FIG. 1. THE WORK

cast-iron sleeves *C* were made a sliding fit on the boring bar *J*, and the feather *I* was fitted to suit the spline *J* in the boring bar. The sleeves were threaded as shown, 11 threads per inch, one right and the other left hand, to suit the nuts *D*, which I made of mild-steel flanges from the scrap pile.

Slots were also put into the sleeves for the boring tool *F* and the threading tool *G*, which were held in position by the mild-steel collar *H*.

The method of working was to rough bore the work to within 1/64 inch of size with an ordinary double-ended cutter fixed in the bar in the usual way. The sleeves were then brought into position and the nuts *D* bolted to the two angle plates *E*. These angle plates were securely bolted to the machine table. The machine was then run at a slow speed, and the finishing tools fed in from both sides. The screw-cutting tools followed. The nuts *D* caused the sleeves to travel the necessary 11 threads pitch right and left hand, there being sufficient clearance in the center of the work to allow of this being done. After the threading was completed the collar *H* was drawn back, the tools removed and the sleeves *C* were fed out again by reversing the machine.

We obtained a satisfactory thread with one cut of the tools, the sections being made of fairly soft material, and we also accomplished the job in much quicker time than was expected, although no attempt was made to break records in cutting speeds.

The usual bar supports of the machine were placed as near as possible to the sleeves *C*.

Belfast, Ireland. F. P. TERRY.

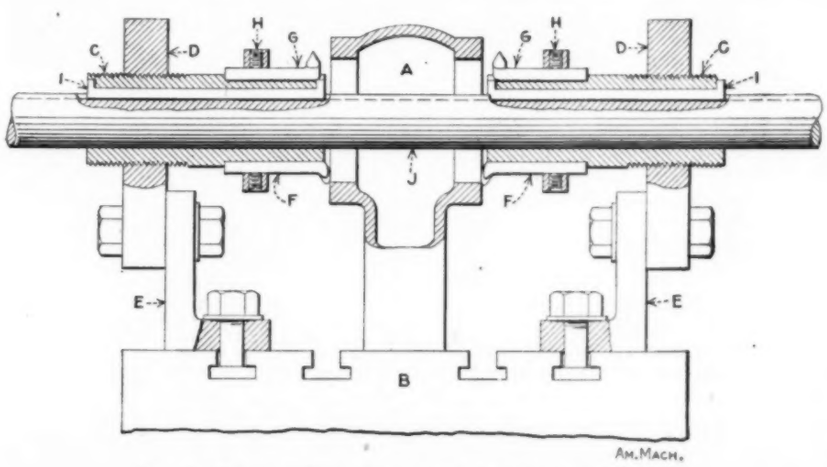


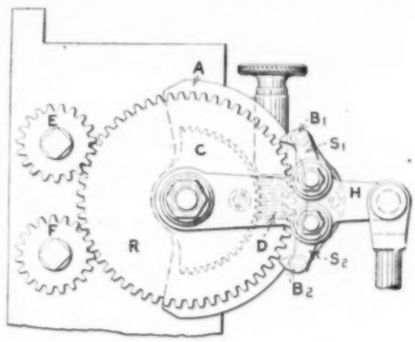
FIG. 2. THREAD CUTTING ON THE HORIZONTAL BORER

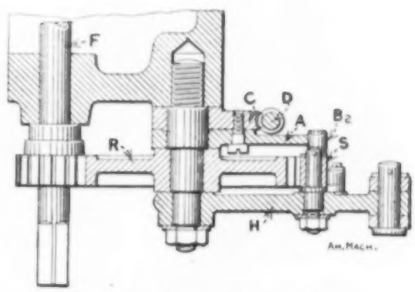
A New Feed Mechanism

This device allows us during work to vary the feed from nothing to maximum, or to reverse its direction, and to do the latter without turning over a pawl or using a reversing coupling. The mechanism can, therefore, be used advantageously on many automatic machines.

The illustration shows how, for example, this drive can be used on the cross rail of a planer for feeding the spindles.

The oscillating lever *H* carries two pawls, S_1 and S_2, which at the shown adjustment of the feed mechanism (middle position with feed mechanism disengaged) rest upon a segment *A* by rollers B_1 and B_2, respectively, so that the pawls do not engage the spur-gear *R*, which serves as a ratchet. Through worm *D* and worm-wheel segment *C*, the segment *A* may be revolved in either direction so far that when the level *H* is oscillated, either one or the other pawl cone engages in the wheel *R*, and this feeds in one direction or the other the spindle *E* or *F*, respectively; the feed being quicker in proportion as the segment *A* is removed from its central position. In order that with either adjustment only one pawl shall act, the rolls B_1 and B_2 must stand separated from each other by a distance somewhat greater than the arc traversed by the rolls, and the segment *A*, in the





A NEW FEED MECHANISM

position shown, must extend on both sides somewhat beyond the path traveled by the rolls, by a distance at least equal to this arc.

Pilsen, Austria. M. KROLL.

Examples of German Screw Machine Work

The firm of Lüdw. Loewe & Co., Aktiengesellschaft, Berlin, Germany, having completed and gotten into working order their shops, built especially for producing automatic screw machines, are continually bringing out either complete newly designed machines, or special and interesting attachments for them.

At the present time, competition in screw-machine lines having reached such a stage, and the customers having profited thereby in being educated up to the minute in all the good points of both the American and German types, anyone wishing to do business at all must hump himself and think out devices, whereby a saving in cost of the machine, or a second or two here or there gained in time of output, can be used to advantage.

Figs. 1 and 2 show front and rear views of the method of tooling up for the production of a safety-razor screw, the operations being plainly indicated and the output was 100 pieces per hour on brass.

Fig. 3 shows the set up for the making of bicycle cones 1⅞ inches in diameter, two of which are shown lying on the machine. The output was 17 per hour from steel, the customer insisting that the ball races be smooth and free from scratches, the operations being drilling with a driven drill combined with a hollow mill, rough forming, shaving and cutting off, the cutoff tool working the whole time in combination with the nurling tool.

In this as well as the foregoing job no tapping was done.

Fig. 4 shows another machine set up for a part of a textile machine, 350 pieces of which are produced in 10 hours. As will be seen all the tools work together, the box mill having rollers for steadying the work while being formed, at the same time taking a shaving cut on the end which has been broken down before cutting off. Note the heavy cutting off attachment from above.

I hope the foregoing will be productive of discussion, as too little is written of these subjects.

Berlin, Germany. D. MILLINGTON.

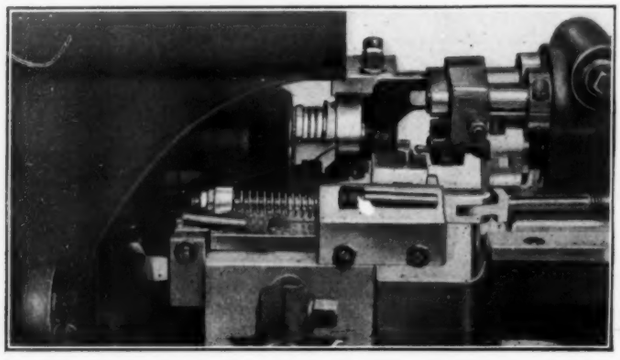


FIG. 1. MACHINE SET UP FOR SAFETY-RAZOR SCREW

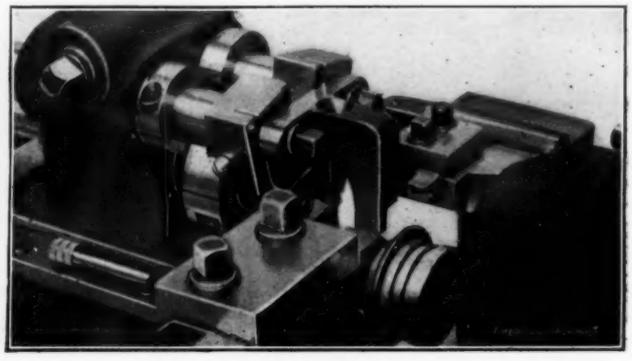


FIG. 2. REAR VIEW OF SET UP

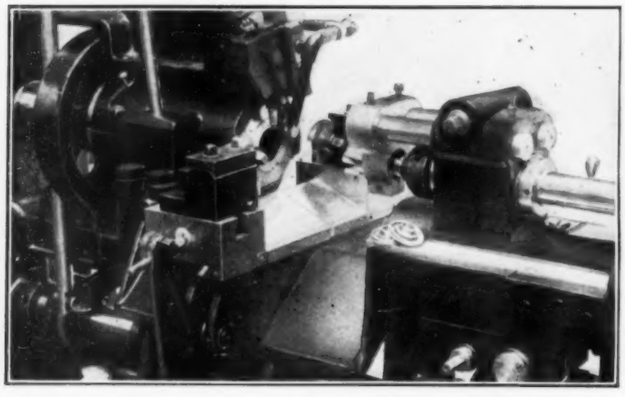


FIG. 3. READY FOR MACHINING BICYCLE CONES

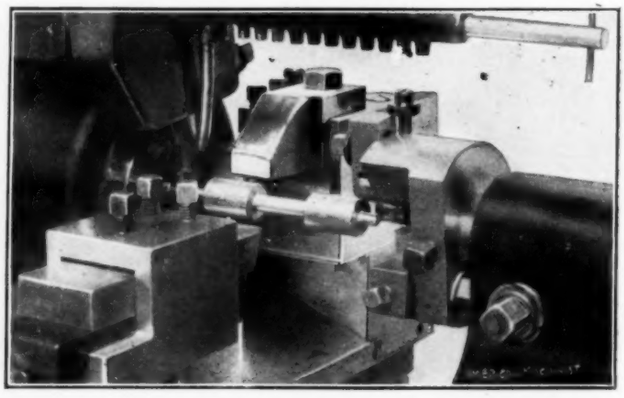


FIG. 4. MACHINE FOR TWINING TEXTILE MACHINE PARTS

One Way of Treating High Speed Steel

We had a number of hard cast-iron disks to be turned with high-speed tools. We used a pretty good feed and speed and the operator was constantly growling about his tools not standing up.

We had tried a number of brands of high-speed steel and were sticking to the one that did the best, but still the service was unsatisfactory. Old Mike, the blacksmith, could not seem to get the right temper to it. He hardened it in oil and in the air blast, but neither of these cooling agents gave results that were entirely satisfactory.

I noticed, one day when he was doing some hardening with the air blast, that a good deal of water came out with the air and that he waited till the air got perfectly dry before he put the tool into it; so some time later, when the operator's complaint was unusually pathetic, I took the tool and went down to the blacksmith shop. I got Mike to heat it up to just the right temperature, and while he was doing so I got the air blast coming with plenty of water in it. Then I let the wet air play on the point of the tool, holding it a little at an angle, so as to harden only the point. The air was spitting water good and hard, and I held the tool there till it was well cooled off. Then I took it back to the shop, ground it up, and the operator put it in place. It did over 900 pieces, though before it had done only two or three hundred.

Although this is something of a departure from the formula which the manufacturers prescribe for hardening high-speed steel, the treatment is not quite so drastic as it might at first appear. It is not like plunging it into water, but cools it rather slowly and leaves the cutting point hard, while just back from and

underneath the point, it is a little softer, which gives the point a good support.

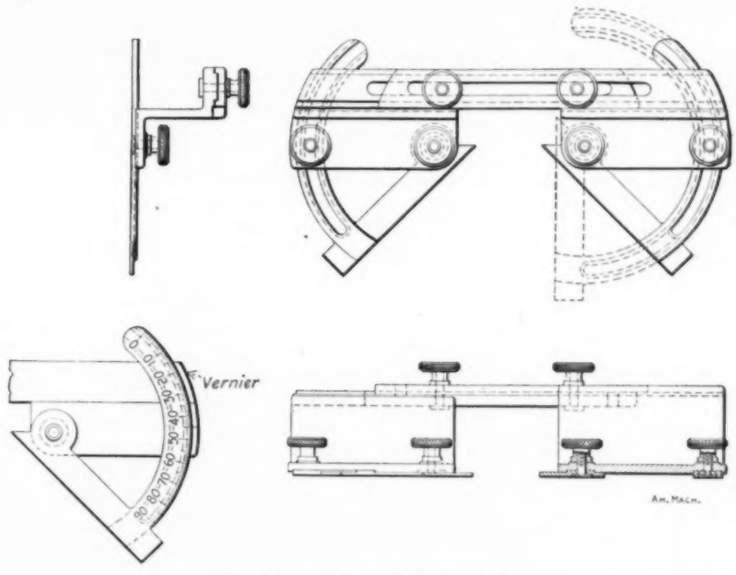
Whenever we have rugged work to perform now, I always resort to this method of hardening, and have never yet been disappointed with the result.

Newark, N. J. W. S. THEIL.

Improved Bevel Protractor

The accompanying illustration shows an improved type of bevel protractor that has been indorsed by master mechanics as a long-sought article.

The object of the protractor is to provide a suitable tool for accurately testing the face angle of bevel-gear blanks or other similar objects, while they are mounted on the arbor and hanging on the lathe centers; that is, to eliminate the objectionable feature of having to remove the arbor from the lathe and then to drive out the arbor before being able to test the angle.



IMPROVED BEVEL PROTRACTOR

The instrument can, of course, be readily adapted to many other uses, but, as stated above, was designed principally to meet the bevel-gear blank demand.

Referring to the illustration, it will be noted that each blade is graduated into degrees on its projecting segment, while a vernier may be readily applied so that the blade or arm can be set to degrees and minutes.

However, the most important feature and the one that is new and original is the method provided of straddling the arbor without interference with the angle blade.

The blade support is offset in this case to allow the straddle of a 3-inch arbor, which, however, may be made to straddle any desired diameter by substituting new blade supports.

Besides straddling the arbor, the blade supports are of telescopic design, so that large or small diameters of work can readily be tested. Proper locking nuts are provided and so located as to give the greatest rigidity to the instrument when in use.

F. K. HENDRICKSON.

Worcester, Mass.

Driving Work in the Lathe with a Square Center

I had about seven hundred phosphor bronze bushings to finish. They were required to be a good press fit in some drop forgings. The job was in a hurry. I had an old twenty-inch engine lathe to do the job on.

The bushings were 2¼ inches long, $1\frac{7}{16}$ inches and $1\frac{7}{16}$ inches bore, finished sizes, with ⅛ inch left for finish all over.

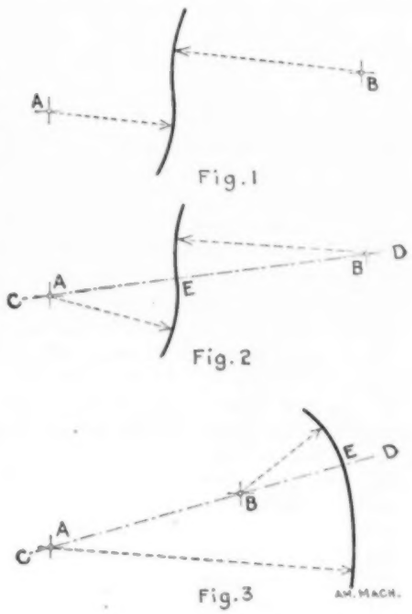
I used a 60-degree square center for the live center and a common center for the tail center. I crowded the bushing up on the center until the edges of the center cut into the bushing, then slackened the tail center and turned the bushing in one cut. I took the bushing out, returned the carriage, placed the next bushing and turned it without altering the position of the tool. I then placed them in the chuck and bored them in one cut with a common boring tool, then faced off one end with the same tool.

In this manner I have finished 102 bushings in 6½ hours, and am sure I can do even better. I also find the square center useful in drawing centers, by placing the square center in the tailstock, then crowding the back end of a lathe tool up against the job close to the end at the tailstock. In this manner the square center cuts the center true with the outside.

Berwick, Penn. FRANK K. FERRY.

Joining Curves

I have noticed that in the drafting room a great deal of trouble exists when, in the course of inking in a drawing, it comes to connecting arcs. Perhaps some of the readers of the AMERICAN MACHINIST who are engaged in this line of work, have had this trouble, and will appreciate



JOINING CURVES

the following simple method of avoiding any such hideous joint as Fig. 1 shows, caused by poor guessing.

The whole trouble in joining arcs comes from the inability of the person to judge the exact point of tangency of the arcs, and unless this point be exactly determined, a good connection is impossible.

In penciling the drawing, the centers *A* and *B*, Fig. 2, are established and the tangent arcs drawn. A line *C D* is drawn through these centers cutting the arcs at *E*. Then *E* is the point of tangency as we may prove by geometry. Now, if in inking the arcs, care be taken to stop them at this point, a neat and satisfactory curve will result.

Fig. 3 simply shows how this applies to curves other than reverse curves.

Hopedale, Mass. GEO. E. CLIFFORD.

Selecting Machine Tools

The often advertised invitation of machine-tool makers to send them drawings and samples of our work and let them quote production and costs, may be convincing proof that they have a machine tool to sell that they are not ashamed of. It may also start managers investigating shop conditions.

Personally, I think there is room for all the various kinds of machine tools

made, and the live manager should, as far as possible, do all the selecting himself.

There is such a variety of conditions and circumstances in every shop which come outside the knowledge of the machine-tool builder and his estimate, that it is necessary for the shop manager to get there first, and, if possible, know beforehand all that the machine-tool builder can tell about his machine.

Two or three samples of work may be submitted, which are ideal pieces for the capstan lathe, while the general run of work in the shop may be more economically done on the vertical boring mill. The capstan-lathe maker cannot be expected to know this and it is poor satisfaction to him to have his machine replaced later and, as sometimes happens, kept as a monument of uselessness to show to all visitors. This is not justice to the man who told the truth about his machine.

Recently, when visiting a shop, I saw a gear cutter which was described to be as "perfectly useless. We got it from Blank & Co. and it never was any good," and, no doubt, it is simlarly described to all visitors. I afterward found this description most unfair. Blank & Co. had been asked to quote by a former manager on a special machine to cut just one shape of gear only, of which this firm had a great number at that time. The design of the firm's specialty was changed and this gear done away with, and as the machine could not be used for general work, it is laid by as "a monument to the inability of Blank & Co. to make a gear cutter." It should have been labeled as an example of the inability of the manager to foresee what the shop might be doing in the future.

Numerous instances of this style of purchasing machine tools could be given, which, no doubt, reached high-water mark when the motor industry was started. Many thousands of pounds was spent on machinery which was used on work quite different to what the maker intended it for. I, myself, saw in one motor shop a long row of engine lathes engaged upon work most suitable for the automatic and turret lathe.

In the purchasing of almost every kind of machinery the expert is usually in the pay of the buyer, and if this were so with machine tools, it would be to the mutual advantage of all. We must, of course, appreciate the machine-tool builder who employs the expert to advise us, but I have yet to meet one who does not prefer to sell his machine to the man who knows exactly what doing a piece of work against the clock means, and whether a day's work on the machine is of 10 or 24 hours' duration without a lot of silly questions.

Belfast, Ireland. F. P. TERRY.

Draftsman's Instrument Tray

The sketch herewith shows a device for keeping the drawing board clear of the litter of instruments, which usually hampers a draftsman in his work. The

DRAFTSMAN'S INSTRUMENT TRAY

tray itself is 10x12 inches, with ¼-inch half-round molding around the edge as a guard. The rod supporting it is ⅜-inch round passing through two clips, as shown, and adjusted in hight by the nut above the lower clip. I find the tray to be a great convenience.

Buffalo, N. Y. J. J. O'BRIEN.

Chilled and Gray Iron Castings from the Same Heat

Some time ago the writer was called to devise a method for producing in a small foundry, making about 20 tons a day of miscellaneous castings, a line of chilled-iron castings approximating about 25 per cent. of the foundry's output.

The chilled-iron castings consisted of miscellaneous wheels, rollers and parts of stone and coal crushers, upon which it was desired that the wearing surfaces should be chilled. They were to be made every day in varying amounts from the same cupola, and during the same heat that a line of ordinary gray-iron castings were to be made.

After some little experimenting it was found that an iron containing about 1 per cent. of silicon would give about the desired depth of chill, and that this could be obtained by using an iron considerably higher in silicon mixed with steel scrap in the correct amounts.

Assuming that the steel scrap contained no silicon, made the calculation for the mixture a very simple one. Thus, if the pig iron in stock carried 2 per cent. of silicon, the calculation for the mixture to obtain 1 per cent. product will be as follows for a charge of 3000 pounds.

1500 pounds	pig iron, 2 per cent. silicon	30 pounds silicon
1500 pounds	steel scrap	0 pounds silicon
3000 pounds	mixture	30 pounds silicon

An important factor in securing a uniform mixture in the ladles, is first to determine by observation the amount of loss in the cupola, due to melting, and by carefully tabulating the weight of the metal in each charge placed in the cupola; then by tapping out of the cupola, as soon as melted, an amount of iron equaling the amount charged less the amount lost in melting, there will be obtained a melted metal of the composition of the charge. If this is not done accurately the steel scrap will predominate in one ladle and the mixture will be low in silicon, hard and will chill deeper than intended, while in other ladles will be found metal in which the pig iron will predominate and which will be higher in silicon, softer, and will not chill.

It is also wise to use care in the selection of steel scrap, which should not be too light, for if it is there will be a large loss in melting. Small, flat pieces used alone are not desirable, as they lie close upon each other and form a diaphragm across the cupola that will interfere with the blast and with uniform melting. Small punchings are also undesirable, for the reason that they are apt to find their way down through the coke and previous charges of metal in sufficient quantities to change their composition. The best is a mixture of angles and other shapes that will not pack together in such a manner as to interfere with the blast in its passage through the cupola contents.

When the melted metal has been brought down into ladles in an amount equaling the charges, test specimens should be immediately cast on an iron chill, then broken and the fracture examined, to see that what was wanted has been obtained, and that no mistakes have been made. If the fracture shows a chill too deep, it can be remedied to a limited extent by adding to the melted iron in the ladle a small amount of ferrosilicon. If the fractured test specimen does not appear to be chilled deep enough, add steel filings to the melted iron in the ladle, but it is best to get the mixtures in the cupola correct and to take out of it the correct amounts at the right times and thus avoid the necessity for making any additions to the melted metals, as any such addition has the effect of lowering its temperature.

Chicago, Ill. ALMON EMRIE.

Efficiency in the Drafting Room

By R. B. Dale*

Although the drawing room is considered non-productive, it renders a distinct service and can save or waste money as the case may be.

Efficiency in the drawing room depends primarily, not on motions, but upon men.

*Instructor, State University of Iowa.

In these days of scientific management our attention is naturally drawn from the productive departments of industrial establishments to the nonproductive departments. There is, perhaps, no nonproductive department that will show greater returns for a careful study of its methods and operations than the drafting room. The drafting room is an expensive department. The works management feels that it is especially expensive because it is essentially nonproductive, that is, its products cannot be sold for cash in the market and its accounts are always on the debit side with nothing to its credit. Inasmuch as the drafting room bears this peculiar relation toward the works, any method or principle which will make for added efficiency will be welcomed.

In the first place it will be well to carefully consider the function of the drafting room. Its aim and purpose in connection with a manufacturing establishment is to provide the shop and others interested with the drawings necessary to describe and define the machinery or parts that are to be manufactured. Its function is, therefore, essentially one of service. It must serve the business office by the aid it may give in making sales, and by the information it may give to prospective or actual purchasers. It must serve the shop by giving it, in the most efficient and simple form, comprehensive, complete and accurate information as to the construction of the work on hand. Incidentally, it is able to furnish a record of the work done in the past. It is further necessary that this information be furnished promptly when needed. These, in a few words, are the reasons for the existence of the drafting room.

This work is performed by skilled men, whom we call draftsmen, mainly without the use of highly specialized tools or machines. This means that the product of the drafting room is mostly a graphical representation of ideas or thoughts, rather than the result of action or of manual labor. It is true that the operation of transferring by means of the hand the thoughts of the brain to the paper is, indeed, a motion operation and may be studied in that relation. It will be seen, however, that the analysis of standardized motions which has been so successfully worked out in connection with machine-tool operations, will not apply to the principal operations of the drafting room.

The Proper Division of Labor

The first step toward efficiency in the drafting room is the division of labor. By this means purely thought operations are separated as much as possible from the purely manual operations. The men who are especially fitted for thought work will not, as a rule, be required to do the manual work. It will, therefore, be possible to apply separately those principles which make for efficiency in each class of work.

In order to make this more clear, an attempt is made in the following paragraphs to describe the organization of the drafting room.

The first person to discuss in connection with the drafting room is the engineer. His duties are those of invention and consultation. Besides his general duties, such as attention to correspondence, attention to and instruction of the salesmen and experts, and the duties of advisor to the superintendent, the manager and other officers of the company, he it is who usually invents and develops the products of the company. He is closely related through the chief draftsman with the work of the drafting room, as a large part of the work emanates from him.

The duties of the chief draftsman are those of the supervision of the drafting room. He is expected to accept the incoming work and assign it to the draftsmen under him. He is responsible for the hiring and the discharge of draftsmen. He is responsible for the discipline of the drafting room. He must see that the drawings are in quantity and quality sufficient for the needs of the shop and office. He must be able to execute drawings and designs and to criticize those made by others.

It is the duty of the designer to develop the invention of the engineer or other person into practical and tangible form. A good designer must be perfectly familiar with the best mechanical practice in his particular line, whether it be high-duty pumps or printing machinery. He must be familiar with modern machine-shop practice. He must know a great deal about mechanical movements and devices and be able to apply this knowledge intelligently to actual conditions.

The detailer must be capable of making complete working drawings from the information furnished to him by the designer. He must be familiar with shop and drafting-room practice and must know what makes a good drawing and what makes a poor one. He must be able to turn out the work rapidly and neatly and the completed drawing must be accurate.

It is the duty of the tracer to trace the pencil drawing. This he must be able to do neatly, rapidly and accurately. The tracer, because he is required to do this only and nothing else, is able to turn out the tracings in the least possible time. The tracer need not be as well informed as the detailer or designer, because his work is practically all a motion operation and requires but very little thought operation.

In most mechanical drawings there is such a multiplicity of parts and so many dimensions and figures that mistakes are liable to occur. It is the duty of the checker to discover these mistakes. The checker is usually a graduate detailer or an experienced designer. If the business warrants it, one, two or more men are constantly employed in checking drawings.

The apprentice is usually employed in making blueprints, running errands and delivering messages, mounting blueprints for the shop, filing drawings for office use and the like.

Efficiency Depends on the Men

From this it will appear that much depends upon organization. An efficient organization depends upon the personnel. Each man should be chosen for his position after a careful examination of his qualifications. Having once established an efficient organization, an especial effort should be made to maintain it. The first step in this maintenance is adequate compensation for the amount of knowledge and skill required for each position. A designer must be paid an amount commensurate with his experience, the responsibility of his position and the amount and quality of the service rendered. It is well to consider that, in addition to being reasonably well paid, a man must be well treated. Contentment and security of position often count for more than money. Consideration is repaid by the loyalty of the workman to the company, and this is an asset that cannot be neglected.

Efficiency is the elimination of avoidable wastes. The wastes of the drafting room are wastes of time and those incommensurable wastes caused by mistakes.

Time is wasted because of faulty administration, lack of facilities, unwilling-

ness, carelessness or accident, ignorance and incompetence.

A Flexible System Needed

The affairs of the drafting room must be carefully and thoughtfully administered. Sufficient dependence must be had in systematized methods that the ordinary routine work will go through with the least possible amount of personal attention. It must be understood, however, that the system may be broken down for the good of the work and to promote the interests of the company. A system is to be used, not worshipped. The chief draftsman must know explicitly the needs of the office and shop in order that he may supply neither too much nor too little information. He must know when a drawing is to be needed, so that he may give the most important things the first attention. He must be responsible for the relation between the drafting room and the shop, so that the two branches may coöperate to the best advantage. He must be given all the authority necessary for the proper administration of his duties. During dull times he may hold his organization together by improving the designs and drawings on hand and working them over into such shape that they may be used with greater facility. In short, his administration must not only be sufficient for the ordinary routine of work but it must provide for emergencies.

Facilities Must Be Provided

In order that the work may be done efficiently, proper facilities must be provided. Advantage must be taken of every device which is a proved time saver, provided the amount and quality of the work will warrant its use. Very fine drawings may be made with crude instruments and facilities, but good tools make possible great savings in time. Not only should the best tools be provided the workman, but he should be surrounded with the proper comforts and conveniences. The room should be large, clean, airy, well lighted and well heated. It should be as quiet as possible and the floors should be free from vibration. Comfortable stools and work tables should be provided. The usual toilet accommodations should be within reach.

Record of Time

The loss of time through unwillingness, carelessness, ignorance and incompetence of the workman is not easy of detection. In order to facilitate the detection of this loss and to assist in cost accounts, it is well to require that time should be kept on each job. A good way to do this is to allow each man to keep his own time. The man should understand that this is not required of him to his advantage, but rather for the advantage and information of all concerned. If every man through whose hands the drawing passed would indicate in some manner the work he performed upon it and the time he spent, the record would be made automatically. Even though this is not required, every draftsman should keep such a memorandum for his own personal use. Such a record should speak volumes to the chief draftsman. It should enable him to judge his men. It would tell him, or assist in so doing, for what class of work each man was particularly suited. If, after a fair trial, it is found that any man wastes time through any of the causes above mentioned, a more suitable place should be found for him or he should be discharged, according to the circumstances. The remedy for such a waste of time is not far to find.

Catch Errors in the Drawing Room

The wastes of mistakes should be most carefully guarded against. Every precaution should be used for their detection. Mistakes are liable to occur in the drafting room, but extreme care should be taken not to permit them to be sent out. Every drawing, no matter how insignificant, should be carefully checked and rechecked, if necessary, to prevent mistakes. A mistake is not a serious matter until after it has passed the checker. Furthermore, the shop foreman should be instructed to be on the watch for mistakes, and if any are found, or a suspicion of any, they should be reported at once, so that the proper steps might be taken immediately to rectify them. Nothing but the heartiest coöperation should be tolerated in this matter, and should a mistake occur, the blame should, if possible, be put fairly upon the proper person.

Importance of Proper Instructions

In discussing these preventable wastes, it is well to say that much may be done by proper instruction. The tracer, for instance, may be shown how to handle his tools for the most efficient service by those who are prepared to do so. The detailer should be encouraged in a study of shop methods and he should be permitted to inspect the work on the shop floor from time to time. He should learn to do this without disturbing the progress of the work in any way. The designer should have an opportunity to learn on every convenient occasion. He should be given every chance to observe the operation of his designs and should be brought freely into consultation with the engineer and with the shop foreman upon any question which is open to discussion.

A careful study of conditions will disclose many preventable wastes in the drafting room. Such wastes have their remedy in a fair and square facing of the condition and its removal. Efficiency in the drafting room depends primarily, not upon motions, but upon men. Good men may be obtained by careful selection and may be held by fair treatment.

Mechanical Engineers Annual Convention

The program of the annual convention of the American Society of Mechanical Engineers, now in progress, presents a diversified list of interesting topics.

One of the most important results of the convention is the impetus it is calculated to give to the forward movement of the society now organizing—a movement intended to make the society as a whole more influential in connection with the broader questions of industrial activities, details of which were outlined in a recent editorial.

The list of papers to be presented, constituting the professional sessions, follows:

"The Turret Equatorial Telescope," James Hartness; "Expense Burden—Its Incidence and Distribution," Sterling H. Bunnell; "Standard Cross-sections," H. de B. Parsons; "Tests of Large Boilers at the Detroit Edison Company," D. S. Jacobus; "Strain Measurements of Some Steam Boilers under Hydrostatic Pressures," James E. Howard; "Herringbone Gears," P. C. Day; "Geo-Dynamics, in the Mechanics of the Formation of the Worlds," Dr. Robert Simpson Woodward; "Core Room—Its Equipment and Management," H. M. Lane; "Tests of a Sandblasting Machine," William T. Magruder; "Die Castings," Amasa T. Trowbridge; "Variable-speed Power Transmission," G. H. Barrus and C. M. Manly; "Oil Engines," H. R. Setz; "Test of an 85-horsepower Oil Engine," Forrest M. Towl; "Design Constants for Small Gasolene Engines," William D. Ennis; "Natural-gas Engine of 1000-kw.: Tests, Construction and Working Costs," E. D. Dreyfus and V. J. Hulquist; "Development of the Textile Industry of the United States," Frank W. Reynolds; "Rational Psyschrometric Formulas," W. H. Carrier; Air-conditioning Apparatus," W. H. Carrier and F. L. Busey; "Some Experience with the Pitot Tube in High and Low Air Velocities," Frank H. Kneeland.

The customary excursions and social activities prevail.

Common sense dictates that the faces formed by the core should be as good as those formed by the body of sand comprising the mold proper. This, however, is not generally the case. Until recent times wooden boxes were largely used in making cores and little care was taken. The baked cores were filed to fit one another or the mold. No attempt was made to produce very accurate holes; in fact, the machine shop frequently preferred to cut openings from solid metal rather than to contend with irregular and poorly cored holes full of adhering sand and scale. There is no excuse for practice of this kind and a machine shop has a right to demand as perfect a finish on the interior of a casting as on the exterior.

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OUTLINE OF TOPICS, PAGE 217

American Machinist

Industrial Education

The wide-spread movement in America for industrial education has been under way for a sufficient length of time for us to now ask the question, Is the movement accomplishing the object originally sought, that of supplying the demand for skilled workmen in the trades and industries?

Several years ago we were told on every hand that the supply of skilled workmen was dying out and that no adequate provision was being made to renew it. To meet this need the National Society for the Promotion of Industrial Education was organized and many experiments were initiated trying various methods of industrial instruction intended to train boys for the trades through some form of schooling.

It was urged at that time that a controlling influence in directing the courses to be pursued should be kept in the hands of manufacturers because it was felt that they knew the needs and that they were the ones most vitally interested because the ones to be helped. That the manufacturers have not assumed or been given this place of leadership, except in isolated cases, is to be regretted. Results seem to show that many of the efforts made are, perhaps for this reason, drifting back into the old channels and appear to the manufacturers to be only playing at learning a trade. It is believed that a proportion of the students now training under these various forms of instruction will not be so trained as to give the manufacturers the kind of help they are looking for. One reason why we believe many boys with such a training will not be in demand is that the whole spirit of their training is "away from the shop" as workmen; that they are having instilled into them the idea that because of their school training they are of a superior class above those engaged in the regular handiwork of the shop and that the only worthy line of success for them is to become foremen or managers over such men.

If our industrial schools would appreciate that there is need of many skilled workmen where one foreman is required, and that such skilled workmen are in greater demand because harder to replace and often secure higher wages than the foreman, that their calling is just as honorable, as interesting and as capable of producing results which will be of service to the world, they would not put these false notions into the heads of boys and they would revolutionize their courses and suit them to the many who should be developed into skilled workmen instead of trying to adapt them to the few who may become foremen or managers and often fail in that.

We believe that the training, whether in school or shop, to produce skilled workers in the trades should be directed specifically to producing such skilled workers—workers skilled in the use of hand and brain, trained in loyalty, judgment and in industrious habits, ready as a result of such training to do whatever work comes to their hands intelligently, accurately and quickly. When such results are obtained we believe that our industrial schools will be fulfilling their office and that in conjunction with our modern apprenticeship system they will produce a virile force of workers, giving increased life to our mechanical industries, as a result of which we shall hear little complaint of the lack of skilled labor.

The Abuse of the Words Efficiency and Scientific

No word in the English language has been more abused than "efficiency," especially during the past year or two. This has reached the point where those whose business it is to improve shop output and conditions, balk at the name "efficiency engineer" of which they were once so proud and are using different titles to convey the same meaning.

Next comes the much maligned "scientific" and the two words may well be used sparingly until we forget the base uses to which they have been put, and they once more come to mean what the dictionary makers and time honored usage intended.

But the agitation which has been raging will make for good, since, after the spasm is over and we settle down to a realization that all of us will bear improvement, also that the human element cannot successfully be bound by the same iron-clad rules as a machine and will always be something of a variable quantity, we shall get down to a more rational and substantial basis.

There are few of the systems advocated which do not contain some good points, the main objections being in most cases that they attempt too much. The great danger is in building up a system that collects data which are never used or not worth what they cost, which puts a barrier between the workers and the executives and which becomes so top heavy that it falls into disrepute and becomes an object of contempt. A system, like a law, must either be enforced or it is worse than useless and should be taken out of active use.

Another common fault is in attempting to make the system cover too many departments. While in theory a good system should be logically extended to the limit, it is far better to confine its application to such departments as prove its practical value.

Nor must it be forgotten that much so called efficiency is only apparent and not real. And just as the coal pile or the cost of power is the only real indication of a steam engine's efficiency, so the net bank account is the real test of a system's worth.

Responsibility of Skilled Machinists to Apprentices

The influence of example is great. Boys learn from the men around them. Apprentices learn from the machinists near whom they work. Thus a responsibility rests upon skilled machinists that should impel them to do the best of work for the sake of its example to the youngsters.

Whatever the apprentice sees the older workmen do he thinks he can do. The boy's excuse that "Bill Jones does it" is too often heard. No machinist working near bright apprentices should think that he is unobserved. It is more than

likely that the smallest things that he does are noted, even to the tightening of a screw.

If he uses a tool that is improperly ground or set, one that chatters and leaves a washboard-like cut, the watching boy is led to believe that such things are all right in the trade.

One trait of the old-time all-around machinist was pride in his work. He liked to do a good job. This characteristic should be revived for the benefit of the boys. They should have a pride in what they do, and this can be fostered or repressed by the men around them.

Are you a skilled machinist, meeting this responsibility and making your own work a good example for the apprentices about you?

NEW PUBLICATIONS

BEARINGS AND THEIR LUBRICATION. By L. P. Alford. Two hundred and twenty-eight 6x9-inch pages; 131 illustrations and 59 tables in the text; indexed. Published by the AMERICAN MACHINIST, McGraw-Hill Book Company, New York City, sole selling agents. Price, $2.50.

Reviewed by Dexter S. Kimball*

The purpose of this book is to present the underlying principles involved in the design of machinery bearings, aside from considerations of strength and stiffness, and to show modern practice in the construction and application of commercial types. The design of sliding bearings of any kind has always been a bothersome and uncertain matter. Even such practical data as we possessed could be safely used only within the limits of the field where these data were gathered; and handbooks contained, and still contain, many formulas laying claim to universal application, which are applicable within very narrow limits indeed. In the case of roller and ball bearings even less was known till very lately of either theory or practice.

The monumental work of Thurston, Tower, Reynolds, Stribeck, Lasche, Kingsbury, Moore and others has, however, provided us with a much more secure basis for this work, and no one can intelligently design even simple bearings without some knowledge of the work of these men. The records of their work and the literature of the subject in general are, however, widely scattered, and because of its great extent, writers of textbooks and engineering handbooks who have attempted to classify and codify this literature have had to content themselves with bare fundamentals and the use of copious references, many of which are out of easy reach of the ordinary practising engineer.

The author of this book has had exceptional opportunity of access to this literature, including the more obscure sources of information, such as the experimental research work of the authorities named above, and an even greater opportunity of seeing the discussions and conclusions which have been drawn from these sources, and published in current literature. He has also had a rare chance to collect compiled data corroborative of good practice, and some of the data here presented have never been published before. From these several sources he has gathered together information on the subject, both theoretical and practical, in a more complete and discriminating manner than has ever before been attempted. The book, therefore, contains the fundamental theory of the subject, reinforced by many valuable data and actual examples of successful construction. It fills a decided gap in our engineering literature, and will command a place in the library of every engineer who has anything to do with either the designing or operating of machinery bearings.

The book is written in a clear and straightforward manner, the arrangement is logical, the classifications good.

The book is divided into two parts; the first and larger part devoted to a discussion of bearings with sliding contact, and the second to a discussion of bearings with rolling contact. Each part is divided into sections corresponding to chapters.

Following is a synopsis of Part I by sections: Section I, entitled "Friction of Bearings with Sliding Contact," contains discussions of the general theory of sliding friction both of rest and at varying velocities; perfect and imperfect lubrication; oil films and the limiting conditions under which they form, and other theoretical phenomena which underly intelligent bearing design; with experimental data bearing on these points. Section II discusses the coefficients of friction for various classes of bearings, and contains many tabulated data of this elusive quantity. Section III, "Materials for Bearings," deals with the physical and chemical properties of bearing metals. It contains some comprehensive tables, giving the analysis and properties of many bearing metals from many authorities. Relative wear is discussed, and practical data from sources covering electrical, marine, railway and automobile practice are presented.

Section IV is entitled "Allowable Bearing Pressures, Speeds and Temperatures." The author, clearly recognizing the inadequateness of any theory to cover these important features, has here gathered a very comprehensive lot of tabulated data embracing many types of machinery. His discussion of the product of unit pressure and velocity on page 85 is noteworthy, since it accurately estimates the value of empirical equations based upon this factor, and which are so often misleading.

Section V, entitled "Design of Journal Bearings," discusses ratio of length to diameter of bearings, giving practical data for the several kinds of machinery; oil grooves and provision for lubrication are also dwelt upon. Of particular importance is the discussion of radiation and dissipation of the heat of friction. The charts giving radiation factors and temperature rise, based on the work of Lasche and others are very useful, as is also the discussion of artificial means of carrying away the heat.

Section VI deals with lubricants for bearings and confines the discussion to the physical properties and tests of lubricating oils, omitting largely the chemical side of the question. A large number of sample specifications of oil for various services are given. Section VII is devoted to the design of sliding surfaces and special features, such as knife-edge bearings.

Section VIII is very short and somewhat unique. It is entitled "Three Important Inventions." These are given as the invention of the process of babbitting by Isaac Babbitt; the invention of the so called Sellers ball-bearing hanger by Edward Bancroft; and the ring oiler invented by John E. Sweet.

Section IX, "Typical Designs and Construction," is a summary of good practice, and contains many sample designs, showing not only details of construction of the bearing, but also types of water circulation, and lubricating systems. Section X is entitled, "Hints on the Care of Bearings," is interesting and instructive reading for those who have to do with operation.

Part II is devoted to a discussion of roller and ball bearings, and consists of seven sections: Rolling Friction and Factors of Design; Construction of Ball Bearings; Typical Designs and Mountings for Ball Bearings; Lubrication of Ball Bearings; Roller Bearings with Flexible Rollers; Radial Roller Bearings with Solid Rollers, and Roller Thrust Bearings. The scope of this part is, hence, seen to be similar to that of Part I; namely, a presentation of basic theory and factors of design, followed by a discussion of their application to practice with many practical data and examples of actual work.

*Profesor of machine design and construction, Sibley College, Cornell University.

A foundry was purchasing city water of a very pure grade at a relatively high cost. To avoid this expense an artesian well was sunk. Immediately trouble appeared. The cores cut and washed and it took some time to trace the difficulty. Fnally the city water was again used and the trouble disappeared. The water from this well was clear, sparkling and tasted good, but it was high in lithia salts and evidently contained ingredients which combined with the binders to destroy them.

Shop Equipment News

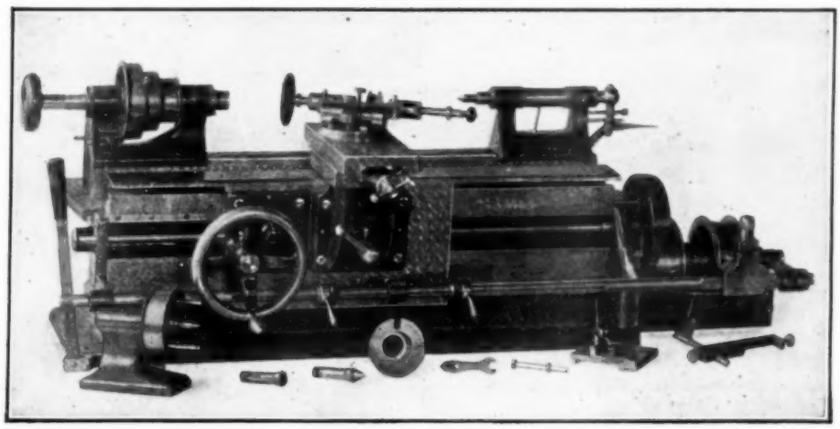
New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

Hardinge Universal Grinder

The accompanying halftone shows a universal grinder recently developed by Hardinge Brothers, Chicago, Ill.

There will be noted at the left a steel plate inserted in the base of the machine, which is graduated to 10 degrees on either side of the zero line. The plate is a 20-degree arc of a circle 36 inches diameter, so that fine readings can be readily observed.

Changing the bed to different angles is accomplished by unlocking two hand nuts, easily reached from the front of the machine. The bed is also designed to carry Hardinge patent bench-lathe heads, sizes from No. 3 to No. 7, inclusive, the spindle and journals of which are protected with felt rings and dust caps, which prevent emery or cutting material of any nature from coming in contact with bearings. Through the use of these heads, in connection with the grinder, one is enabled to use draw-in chucks, wheel chucks, faceplate, universal or independent-jawed chucks.



HARDINGE UNIVERSAL GRINDER

The halftone shows the other attachments, namely, No. 191, dead-center head; No. 139, finger for supporting the teeth of straight face cutters while sharpening, and No. 193, finger for supporting the teeth of spiral cutters while sharpening.

The traverse spindle is hardened and ground, and runs in adjustable journals, which are protected with felt rings. In each end of the spindle is a standard taper hole. The spindle head is graduated to 360 degrees.

The spindle upon which the grinder head is mounted is the three-slide style, enabling the operator to move the wheel to or from the work rapidly, while fine feeds are attained through the use of the index slide.

The power feed is constructed so the operator may change the lengths of cuts immediately, and may also obtain a micrometer adjustment through the use of nurled nuts on the feed-control stops. For hand operating it is necessary only to release the split nut and use the handwheel.

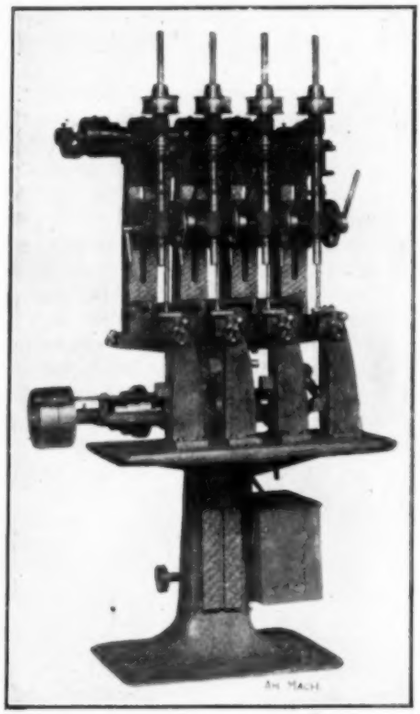
The countershaft is arranged to get a variation of speeds, and is constructed so that the work, emery wheel or both may be stopped independent of the main drive.

Four-spindle Stay Bolt Driller

The machine shown herewith has been designed expressly for drilling telltale holes in stay-bolts.

The machine has a capacity of four $\frac{5}{16}$-inch drills and will take in stay-bolts from $\frac{3}{4}$ inch to $1\frac{1}{4}$ inches in diameter and from 3 inches to 15 inches long. Each spindle is provided with three independent speeds and has two changes of power feed. Power feed is equipped with automatic knockoff, which can be set for any depth within the capacity of the machine. Both feed and speed can be readily changed on any spindle without changing the other spindles.

Specially designed chucks with quick-acting gripping mechanism center the stay-bolts beneath each spindle and hold them rigidly in position. A hardened bushing is provided for the drill to run in, insuring its starting central with the piece held in the chuck. An oil pump is provided with return tank. The stay-bolt chucks are readily removable, leaving the machine available for sensitive drilling.



FOUR-SPINDLE STAY-BOLT GRINDER

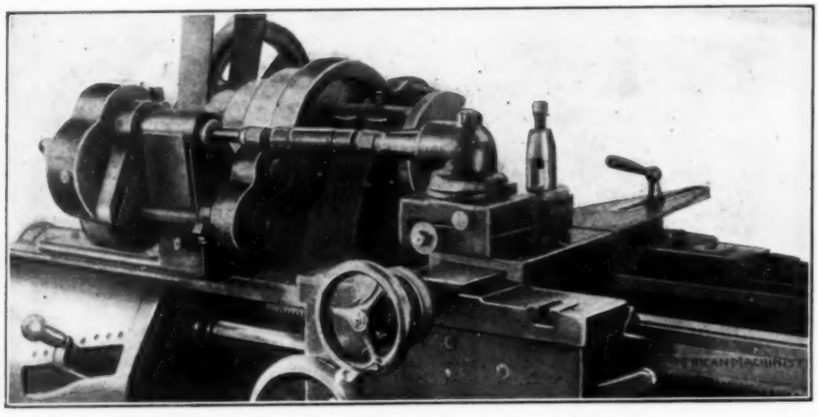
This machine is a recent product of the Foote-Burt Company, Cleveland, Ohio.

Relieving Attachment

The accompanying halftone shows a new relieving or backing-off attachment developed by the Seneca Falls Manufacturing Company, Seneca Falls, N. Y., for use on their 14-inch and 16-inch quick-change tool-room lathe.

The tool slide is attached to the cross slide of carriage in place of compound

rest, and will operate at any angle through an arc of 180 degrees—90 degrees each way from the center of carriage. The lower part swivels on the cross slide the same as the compound rest, and the upper part, containing a pair of bevel drive gears, swivels on the lower part to permit the free working of the driving shaft, which is connected to the driving mechanism by universal joints. The stroke can be adjusted while the machine is in motion to give any amount of relief, from 0 to ¼ inch; the amount is indicated by graduations on adjusting knob.



RELIEVING ATTACHMENT FOR SENECA LATHE

The driving mechanism is attached to the bed in front of the headstock and receives power from the head gear. The number of strokes per revolution of work is governed by change gears. A set of gears is furnished giving 22 variations, including all numbers from 2 to 16, and even numbers from 18 to 30.

The attachment is readily connected or disconnected. The tool slide is removed by loosening the binding screw and pulling out the splined shaft from the driving mechanism; then the driving gear is thrown out of contact with the head gear.

This attachment may be used in connection with the taper attachment and micrometer cross-feed stop, also with power cross and longitudinal feeds.

Quick Change Chuck

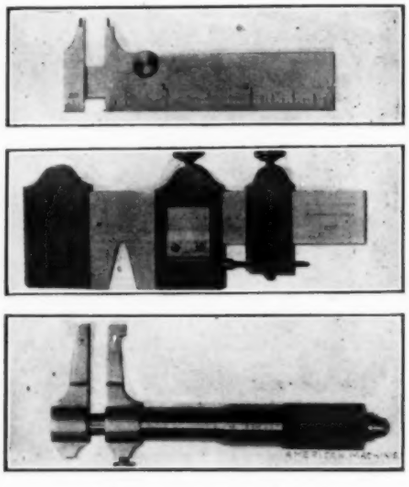
The Machine and Tool Manufacturing Company, Cleveland, O., is placing on the market a new line of chucks for use in vertical drillers, screw machines and horizontal boring mills. They are simple in construction and the sockets can be instantly changed without stopping the machine, by raising an outer sleeve. This allows the socket to be taken out, and a new socket is then inserted in its place. The outer sleeve then drops down by gravity and holds the socket in place. The drive is through the tang of the socket.

The chucks are made in three different sizes, No. 1 taking taper shanks 0, 1 and 2; No. 2 takes taper shanks 1, 2 and 3, and No. 3 taper shanks 2, 3 and 4.

Machinists' Fine Tools

The three machinists tools shown in the accompanying halftone are recently improved designs made by the Brown & Sharpe Manufacturing Company, Providence, R. I.

The pocket-slide caliper rule, No. 357, shown in the upper view was designed for measuring washers, nuts, selecting stock, and for any similar work where both internal and external measurements are required. One side is graduated as an ordinary 3-inch rule, the graduations reading to 32ds. On the other side, the slide is graduated to 64ths and has a range of 2 inches. It can be securely clamped in position by a clamped nut.



MACHINISTS' FINE TOOLS

Another pocket-slide caliper rule, button gage, No. 385, not shown, is similar, the only difference being that the graduations of the slide read to 40ths of an inch, therefore adapting a tool for use as a button gage.

The tool shown in the center view is a thread-tool vernier for measuring thread tools of different pitches. When a thread tool is to be measured the sliding jaw of the vernier is set for the width of point of the tool of the required pitch. The thread tool is then ground so that the point bottoms on a hardened-steel strip inserted in the blade and the sides rest against the jaws of the tool. The hardened-steel strip is placed on the blade of the vernier in order to provide against wear. The jaws or measuring surfaces are carefully hardened and ground, the angle being tested for accuracy. The vernier reads to thousandths of an inch. The tool reads to one inch.

The inside micrometer caliper shown in the lower view has a range from ½ inch to 1½ inches and the design of the caliper has been changed slightly, the jaws being a new shape. The measuring screw is entirely inclosed, thus protecting it from injury while the measuring surfaces are hardened and ground to a radius to insure accurate measurements and prevent clamping when measuring parallel surfaces. A clamp screw to preserve the setting is provided. The graduations read to thousandths of an inch, or, when the caliper is made in metric measure, read from 13 millimeters to 38 millimeters by hundredths of the millimeter.

A half-inch micrometer head has been added for use with machines or tools wherever fine adjustments are required. Its design permits of its being readily attached in any position so that accurate adjustments can be made. The measuring screw is entirely inclosed, thus protecting it from dirt and injury and the measuring surface is hardened and ground to insure it against wear. The graduations are accurate and the head can be furnished to read either to thousandths or ten-thousandths of an inch as desired and with or without ratchet stop. It can also be furnished to read to hundredths of a millimeter.

German Vertical Keyway and Slot Miller

The firm of De Fries & Co., Düsseldorf, Germany, is building keyway and slot millers which are essentially different in construction and operation from the earlier machines of their make.

In all their previous slot millers, with vertical spindles, the cutter was fed into the work at each end of the slot, and then moved horizontally. By this method, in order to cut a keyway 25 millimeters (0.984 inch) wide, and about 10 millimeters (0..393 inch) deep, it was necessary to take 10 successive cuts of 1 millimeter each. In this way, even at high cutting speed, a much longer time was consumed than on the new De Fries & Co., slot miller, wherein it is the prac-

tice first to mill vertically to the correct depth of a standard keyway, and then horizontally, so that the slot is finished at one pass and the working time is often reduced to a fifth, or even less, of what was taken on the old type of machine.

The new machines are built in three sizes. The smallest, which is marked No. 0, mills standard keyways up to 16 millimeters (0.629 inch) wide, 6 millimeters (0.236 inch) deep, and 300 millimeters (11.81 inches) long. The second machine, No. 1, mills standard keyways up to 25 millimeters (0.984 inch) wide, 10 millimeters (0.393 inch) deep, and 800 millimeters (31.496 inches) long. The third, and largest machine, No. 2, mills standard keyways 70 millimeters (2.755 inches) wide, 15 millimeters (0.590 inch) deep, and 1000 millimeters (39.270 inches) long. If it be desired to mill very deep keyways or slots all the way through the work, the cut is repeated as many times as necessary, the vertical and horizontal feeds being reduced if need be.

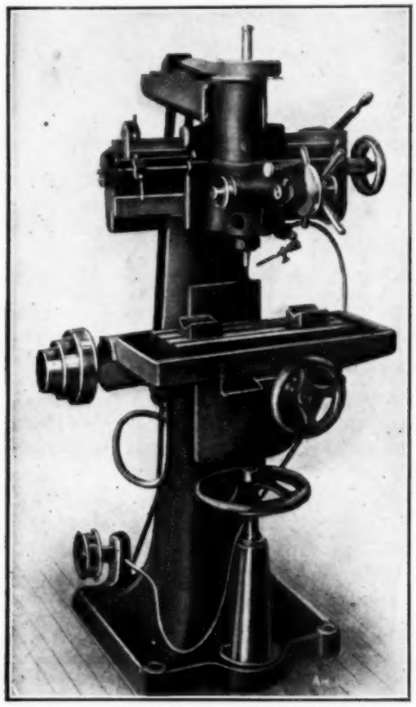


FIG. 1. DE FRIES NO. 0 SLOT MILLER

Fig. 1 shows the No. 0 machine. It is considerably simpler in design than the others. The vertical feed is by hand only and is operated by the handwheel at the right of the spindle bracket. The horizontal traverse is automatic and is provided with an automatic stop which trips the cut at a predetermined point.

The spindle is belt driven from the drum at the rear of the machine. Three speeds are provided through the cone pulley on the drum shaft at the left. The knee is vertically adjustable on the column.

The platen is provided with cross feed and has T-slots for holding the work. A pan surrounds it for the reception of the lubricant. This machine weighs 1100 pounds.

Fig. 2 shows a rear view of the No. 1 machine.

The spindle carriage is carried on the top of the column. The construction and control of the knee and table are practically the same as in the No. 0 machine.

The spindle drive is through spiral gearing from a splined shaft at the rear. The carriage may be traversed either automatically or by hand. A scale on the guide facilitates accurate setting of the longitudinal movement.

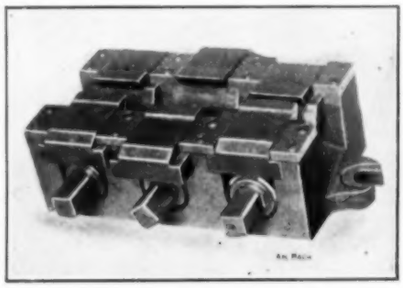


FIG. 4. THE SLOT-MILLER VISE

The vertical feed of the cutter spindle is automatic and is controlled by a screw and nut. Three gradations of feed are obtainable by means of gearing. The depth of cut is set by graduated mechanism provided with an indicating device. The vertical feed is provided with an automatic stop when the correct depth is reached.

The longitudinal and vertical feeds are both obtained from the diagonal shaft through a gear box.

On completion of the traverse of the longitudinal slide the feed is automati-

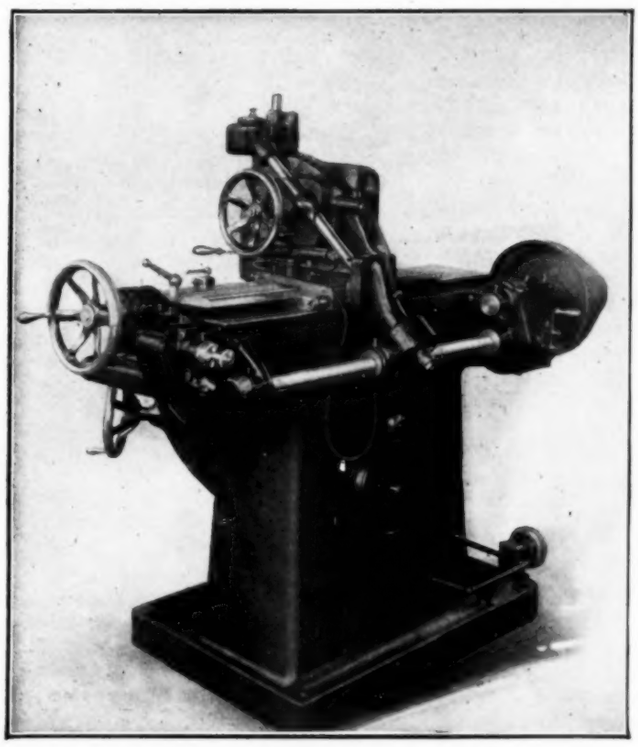


FIG. 2. REAR VIEW OF NO. 1 DE FRIES SLOT MILLER

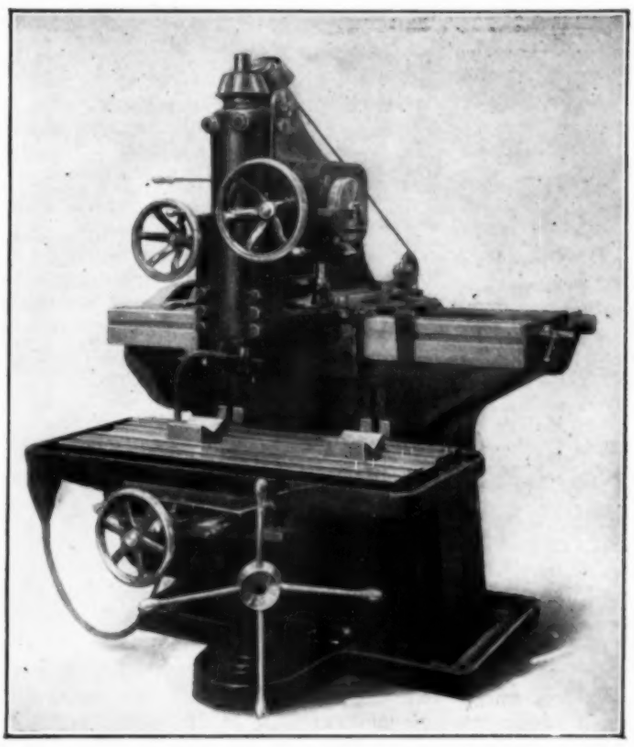


FIG. 3. FRONT VIEW OF NO. 2 DE FRIES SLOT MILLER

cally thrown out and an electric bell notifies the operator that the operation is completed. This machine weighs about 3850 pounds.

Fig. 3 shows the No. 2 machine. In this machine, which is very similar to the one just described, the spindle is driven by bevel gears. The hand traverse of the spindle carriage is by means of a handwheel on the carriage itself. This machine weighs 9680 pounds.

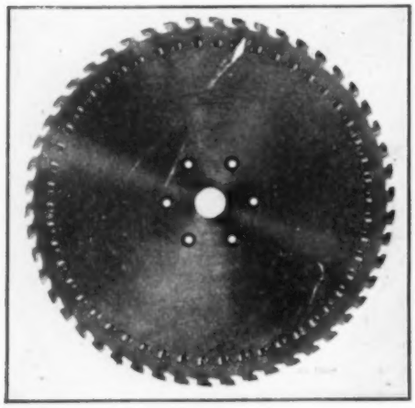
All these machines can be used for drilling, boring and end milling.

The face milling attachment furnished, if desired, with the Nos. 1 and 2 machines, consists of a special driving head, whereby the cutter-spindle can be given a considerably lower speed, and a feed-box whereby the feed can be considerably increased. Special cutters for slot milling are made of special tool steel, and also of high-speed steel. The sizes from 4 to 30 millimeters (0.157 to 1.181 inches) diameter are given two, and those from 31 to 70 millimeters (1.220 to 2.755 inches) diameter, three cutting edges. These cutters are so made that they leave no core when fed vertically. Fig. 4 shows the vise used for gripping shafts while being splined on this machine. The opposed V-shaped jaws are operated by right- and left-hand screws as shown.

Duplex Inserted Tooth Saw

The accompanying halftone shows a duplex inserted-tooth saw blade, recently manufactured by the Hunter Saw and Machine Company, Pittsburg, Penn.

The body of the blade is made of vanadium alloy tool steel, while the teeth are made of high-speed steel.



INSERTED TOOTH SAW

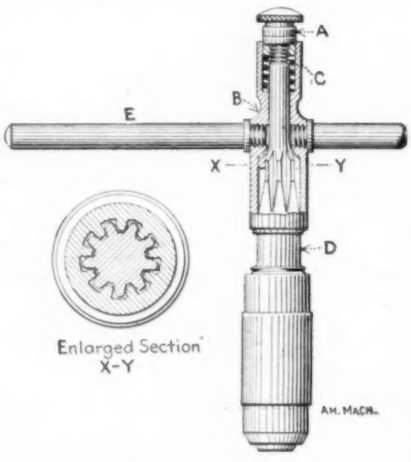
The teeth are secured by interchangeable tool-steel wedges, lowered to brass adjusting screws. Roughing or round teeth are adjusted higher than finishing or flat teeth, so that a parting cut can be made taking the remaining portion of material with the flat or finishing teeth.

The blades are manufactured in sizes ranging from 6 to 85 inches in diameter.

A Ratchet Tap Wrench

The line cut shows a new ratchet tap wrench, which is manufactured by the Alert Tool Company, 4731 N. Mascher street, Philadelphia, Penn.

The shank *D* of the wrench has teeth formed on it, which engage with teeth formed inside the sleeve *B*. The upper end of the shank of *D* is provided with a nurled nut *A*, which bears on the compression spring *C* in the upper part of the sleeve *B*. The compression spring *C*



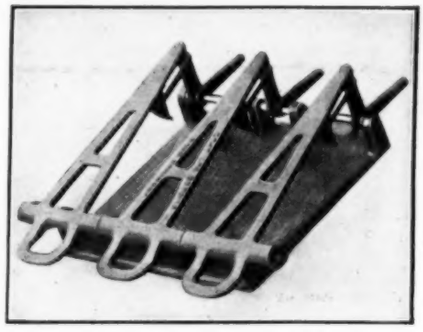
A RATCHET TAP WRENCH

normally holds the shank *D* and sleeve *B* in such position that the teeth in each are engaged with each other. A slight pressure of the thumb or palm of the hand on *A* throws the external teeth on *D* out of engagement with the internal teeth in *B*, and the sleeve is free to turn in either direction. In this way the wrench is a right- or left-hand ratchet tap wrench at the will of the operator. The crossbar *E* can be removed and a single-ended lever inserted in its place for working in confined places. These wrenches are made in sizes from 1/8 to 3/4 inch.

Automatic Locking Foot Treadle

The accompanying halftone shows a style of treadle shifter recently developed by Hardinge Brothers, Chicago, Ill..

The belt is shifted to the tight pulley by the downward movement of the treadle, which is connected to the countershaft fork by a wire. The upward pull of the wire locks the treadle. To unlock and stop the lathe spindle, it is necessary to touch only the heel part



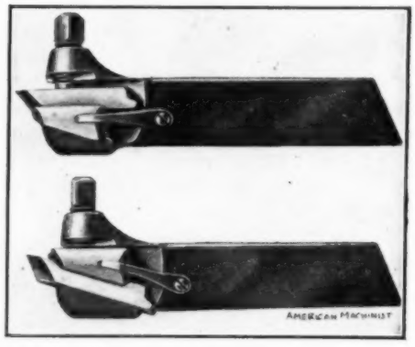
LOCKING FOOT TREADLE

of the treadle. This treadle is made in single, double and triple forms.

Lathe Tool Holder

In the tool holder shown in the accompanying halftones, the cutting tool may be adjusted or changed in the holder from a level position to a tilted one, or *vice versa*, so that iron, steel, brass or other metals can be turned without the necessity of taking the holder from the tool post. The cutting tool is clamped firmly on all sides and held rigidly.

The cutting tool when clamped in the holder in tilted position is tipped out of square, thus giving clearance for fast,



LATHE TOOL HOLDER

heavy work, and when clamped without being tilted, the cutting edge is square with the work.

This tool holder is a recent product of the Krieger Tool and Manufacturing Company, Grand Rapids, Mich.

Post Drillers

A new line of post drillers, including both power- and hand-driven types, has recently been developed by the Silver Manufacturing Company, Salem, Ohio.

The drills are intended to operate at a speed of approximately 250 revolutions per minute, and are equipped with a ball-bearing feed nut. An automatic feeding device, located back of the spindle, is operated by a cam inside of the gear wheel, thus giving a practically continuous feed.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

Metal Working

NEW ENGLAND

The S. L. Crosby Company, Bangor, Me., will erect a large garage.

The George H. Tabor Company's garage at Houlton, Me., was recently destroyed by fire.

William A. Heaphy will erect a modern garage and repair shop on Main street, Lee, Mass.

F. G. Loring, Eastport, Me., is building a large garage to run in connection with his machine shop.

Work has commenced on the new casting shop, on West Main street, for the Waterbury (Conn.) Brass Company.

The American Steel and Wire Company, of New Haven, Conn., will build an addition to its plant on Fairmount avenue.

Frank Ballard and Henry Saunders are erecting a commercial garage at the corner of School and South streets, Athol, Mass.

The Frank B. Lothrop Company, South Acton, Mass., is in the market for a power press, about 2000 pounds, turret lathe and power riveter.

A new garage is being built for Donald Mackenzie, of the firm of Mackenzie & Bryant, automobile supplies, Lowell, Mass. Equipment is needed.

Fire destroyed the factory building on Ashland street, North Adams, Mass., occupied by the North Adams Paper Stock Company, and M. F. Monohan, boilermaker. Loss, $10,000.

The Knight Garage, Inc., New Haven, Conn., has incorporated with $15,000 capital to conduct a garage. Incorporators are Harry T. Hotchkiss, George E. Tester and Pierrepont B. Foster.

The Brown Speedometer Company, New Britain, Conn., recently incorporated with $200,000, has leased a part of the Corbin Screw Corporation plant, that city, and will equip for manufacturing.

Fish Marine Indicator Company, of New London, Conn., has been incorporated to make and deal in marine indicators, etc. Capital, $30,000. Incorporators, Edwin A. Fish, of New London; George E. Fellows and Lewis R. Church, both of Norwich.

Bridgeport Engine and Equipment Company, of Bridgeport, Conn., has been incorporated to make and deal in engines, mill supplies, etc. Capital, $50,000. Incorporators, Wm. C. Buckelen, Wm. J. Snadecki, both of Bridgeport, and T. P. C. Forbes, of Freeport, N. Y.

MIDDLE STATES

The R. B. Biscuit Company, Cleveland, O., will erect a garage.

Transformers are needed by the city of Cleveland, Ohio, for lighting plant.

The Cleveland Builders' Supply Company, Cleveland, Ohio, will erect a garage.

Fire destroyed the boiler shops of the Avery Company, Peoria, Ill. Loss, $160,000.

The Bolmer Motor Car Company, Bound Brook, N. J., is building a new garage.

The Michigan Steel Castings Company, Detroit, Mich., is erecting a new foundry.

The Standard Welding Company, Cleveland, Ohio, will make additions to its plant.

The garage of J. Gallagher, at 1853 Welsh road, Philadelphia, was burned. Loss, $4000.

The Monitor Clock Works, Medina, N. Y., is having plans prepared for a new factory.

U. G. McNitt, Chicago, Ill., will build a $10,000 garage at 5656 Evanston avenue north.

The Dresden (Ohio) Mill Company will erect a new mill and elevator. T. P. Perkins, manager.

Parish & Bingham Company, Cleveland, O., maker of steel stampings, will make additions to its plant.

Chicago (Ill.) Iron and Metal Company, 3000 South Kedzie avenue, will build a one-story addition.

The Pioneer City Laundry and Cleaning Company, Marietta, Ohio, will need some laundry machinery.

The Elgin, Joliet & Eastern Railroad has had plans prepared for a $40,000 roundhouse at Rossville, Ill.

The plant of the J. Baum Safe and Lock Company, Cincinnati, Ohio, was destroyed by fire. Loss, $150,000.

The Tritt China Company, Niles, Ohio, has raised its capital to $100,000 and will want some new equipment.

The Superior Drop Forge Company, Cleveland, Ohio, will build and completely equip a large machine shop.

The Colfax Manufacturing Company, South Bend, Ind., manufacturing concrete mixers, will erect a new plant.

Metal Flanged Concrete Pipe Company, Mt. Gilead, Ohio, will want some machine tools. T. B. Maten, manager.

H. C. Doman will remodel the old Y. M. C. A. building, at Oshkosh, Wis., and install machine shop and garage.

The Electric Welding Products Company, Cleveland, Ohio, has been issued a permit for an addition to its plant.

The Shield-Chapin Construction Company will build an automobile garage at Thirty-sixth and Salem streets, Indianapolis, Ind.

The repair shops and barns of the St. Joe Valley railway, at Lagrange, Ind., were destroyed by fire recently.

The Art Stove Company, of Detroit, Mich., manufacturer of stoves and ranges, is to erect an addition to its plant.

The repair shops of the Detroit, Toledo & Ironton Railway Company will be removed from Napoleon to Lima, Ohio.

The Shawnee Refrigerator Company, Xenia, Ohio, will need wood- and metal-working tools. W. S. Wright, manager.

The Defiance (Ohio) Utilities Company will be in the market for electric-light plant equipment. T. J. Ansberry is manager.

Fire destroyed the commercial garage of the Livery and Transfer Company, at Lisbon, Ohio. Will rebuild and equip.

The Coudersport (Penn.) Mangle Roller Manufacturing Company will establish a branch plant at Lake Placid, N. Y.

Contracts have been let for the new $27,000 plant of the Pressed Steel Tank Company, West Allis, Wis. Size, 260x120x32.

The Sheet Metal Manufacturing Company, 2440 West Lake street, Chicago, Ill., will build a one-story addition and add new tools.

The Clark Roller Bearing Company, of Philadelphia, Penn., will close its factory there and establish one in Poughkeepsie, N. Y.

The Criterion Motor Company, of Kent, Ohio, is figuring on the erection of a large automobile factory in the southern part of Kent.

The American Car and Foundry Company, 2501-11 South Wood street, Chicago, Ill., will build a one-story hammer shop and equip same.

Mead & Musser Company, Cleveland, Ohio, has been organized to equip a factory to make hardware specialties. R. C. Linder, manager.

Second-hand, New Haven, Prentice, automatic turret machines, Nos. 23 and 53, are wanted. Address Box 643, AMERICAN MACHINIST.

The Rose Machine Company, Grand Rapids, Mich., has increased its capital and will enlarge its plant. Sewing machines are manufactured.

The American Blower Company, of Detroit, Mich., manufacturer of air blowers and ventilating systems, is erecting an addition to its plant.

The Northern Ohio Traction and Light Company is in the market for shop equipment, including machine tools. General offices, Akron, Ohio.

It is reported that the New York Central railroad will spend $2,000,000 on a railroad yard, with shops to employ 1000 men, at Miller, Ind.

The Belt Line Railroad Company, Cleveland, Ohio, has purchased a tract of land and will soon start erecting car-repairing and machine shops.

The Aetna Rubber Company, Cleveland, Ohio, has been incorporated with $20,000 capital to manufacture rubber specialties, by H. E. Johnson.

The Consolidated Pottery Company, East Palestine, Ohio, just organized, will need some pottery-making machinery. D. H. McIntosh, manager.

The plant of the H. W. Caldwell & Sons Company, manufacturing power-transmitting machinery, was damaged by fire to the extent of $30,000.

The Leabargen Manufacturing Company will build a plant at Hamilton, Ohio, for the manufacture of perforating machinery for making rolls for automatic pianos.

The Automobile Club of Philadelphia has let contract for a large garage in connection with its club house, at Twenty-third and Ludlow streets, Philadelphia, Penn.

The Brown Company, Syracuse, N. Y., is having plans prepared for a factory at Belle-

vue avenue and Chester street, for the manufacture of automobile specialties.

National Aëroplane Company, Chicago, Ill., has been organized to manufacture aëroplanes, etc., by Howard Sainn, W. S. Sainn, E. M. Splates. Capital, $10,000.

The Havers Motor Car Company, of Port Huron, Mich., has increased its capital and will double its output. Equipment will be needed. Fred Havers, president.

The Chisholm & Moore Manufacturing Company, Cleveland, Ohio, has awarded contracts for an addition to its machine shop. Some new equipmnet is to be installed.

United States Steel Grain Door Company, Chicago, Ill., has been organized with $5000 capital to manufacture steel grain doors, by J. E. Burds, G. Burds and H. W. Drew.

The Hart & Crouse Company, Utica, N. Y., manufacturing furnaces and heating boilers, has commenced the erection of a foundry, machine shop and warehouse on Turner street.

A new plant, larger in size, is being contemplated by the International Hoist Company, manufacturer of gas engines, hoists, builders' materials and foundry work, Antigo, Wis.

The Wishart-Dayton Auto Truck Company, New York, has been incorporated to manufacture motor vehicles. Capital, $25,000. Incorporators, R. A. Inch, S. E. Wishart, J. B. Smith.

The J. Q. Clark Tank Company, of Crawfordsville, Ind., has been incorporated to manufacture tanks and watering fountains. J. Q. Clark, J. H. Elder, H. S. Binford, stockholders.

A new steel plant, consisting of eight open-hearth furnaces, having capacity of 1000 tons of steel per day, will be built in the vicinity of Cleveland, Ohio, by Corrigan, McKinney & Co., of that city.

The Mogul Motor Truck Company, Chicago, Ill., has been incorporated to manufacture motor vehicles. Capital, $125,000. Incorporators, Geo. C. Griffith, L. S. James, Frank Dawson, etc.

Moore Motor Truck Company, Toledo, Ohio, has been organized with $10,000 capital to manufacture and sell automobiles, motor trucks and accessories by D. W. Bliss, M. M. Bliss, E. L. Skidmore, etc.

The International Typesetting Machine Company, New York, has been incorporated to manufacture typesetting machines. Capital, $4,000,000. Incorporators, H. Ridder, J. E. Ridder, B. H. Ridder.

The American Steel Belt Company, Pontiac, Mich., has been incorporated to manufacture steel and leather belting. Capital, $50,000. Incorporators, M. M. McGrath, D. L. Davis, R. K. Cronkhite.

The General Baking Company, a $25,000,000 concern, with plants in 18 cities, will erect and equip a large modern bakeshop at Cleveland, Ohio. Address, now, 1885 East Thirty fifth street, Cleveland, Ohio.

The McCormick Sanitary Trap Company, Chicago, Huron county, Ohio, has been organized with a capital of $15,000 to manufacture sewer traps, etc., by O. C. McCormick, J. W. Sheidley, J. S. Keefer, etc.

The Buffalo (N. Y.) Motor Vehicle Service Company has been incorporated to manufacture, repair and deal in motor vehicles. Capital, $100,000. Incorporators, W. R. Huntley, J. H. Vail, C. R. Huntley.

Solar Inverted Arc Lamp Company, Chicago, Ill., has been incorporated with $10,000 capital to manufacture gas and electric fixtures and appliances, by David Broutman, Isadore S. Krinsky, Samuel Solomon.

The Twentieth Century Concrete Mixer Company, of Butler, Ind., has been bought by business men of Connersville, Ind., and the plant will be moved to Connersville. The new company will largely increase the output of the mixers.

The Twentieth Century Manufacturing Company, Mansfield, Ohio, has been incorporated with $50,000 capital to manufacture washing machines, churns and other novelties by John Howard Glasener, William B. Martin, J. Lloyd Hunter, etc.

The Campbell Brothers Manufacturing Company, Harrison, Ohio, has been organized to manufacture agricultural implements, machines and operate a machine shop by Albert M. Campbell, Harry O. Campbell, Elmore E. Campbell, etc. Capital, $35,000.

The Crane-Hawley Company has acquired site for a new factory at Ninth and Broadway, Cincinnati, Ohio, on which a new six- or seven-story building will be erected at an estimated cost of $300,000. The concern manufactures steam, gas and water supplies.

The Westinghouse Electric and Manufacturing Company, East Pittsburg, Penn., is building a four-story addition to its plant for the manufacture of electric appliances, and is also building a one-story shop for the manufacture of wooden boxes and packing cases for that company's use.

SOUTHERN STATES

The Georgia Supply and Machine Company, Rome, Ga., has been organized with $60,000 capital. Will operate foundry. M. N. Griffin, president.

The United Railways and Electric Company, of Baltimore, Md., will erect a new car barn and machine shop on the Harford road, Baltimore.

The Kanawha Auto Truck Company, Charleston, W. Va., has been incorporated with $50,000 capital to manufacture and sell automobiles. Incorporators, Geo. F. Yates, W. S. Roberts, D. S. Gunther, J. S. Sydensticker and J. D. Woodroe, all of Charleston.

WEST OF THE MISSISSIPPI

The Colby Motor Company, Nason City, Iowa, has plans prepared for a new plant.

S. T. Johnson, Grace avenue, Oakland, Cal., will build a new machine shop on East Lowell street, Oakland.

Barber & Foote, Artesia, Cal., will erect a commercial garage and repair plant. Modern machinery will be installed.

The Western Pacific Railway Company has taken out a permit to build an addition to its freight car repair shop at Oakland, Cal.

The Santa Fé Railroad Company is rebuilding and enlarging its roundhouse, at Seligman, Ariz., recently demolished by fire.

The Empire & Pacific Mines Company, Plymouth, Cal., is building a new blacksmith shop. A new sawmill plant will be erected.

W. B. Gray, Ellensburg, Wash., is having plans prepared for a commercial garage and repair plant. Modern equipment will be installed.

C. F. Brey, Pico street, Los Angeles, Cal., will build a commercial garage and repair plant on Adams street. Modern equipment will be installed.

The Brown Spring Ice Skate Company will erect new factory at Webster City, Ia.

R. L. Michaels' blacksmith shop at Hecla, S. D., was burned.

The Cousins-Howland Auto Company, Hanford, Cal., will erect a commercial garage and repair plant. The plant will be equipped with modern machinery.

The Henrich Real Estate Company, Denver, Colo., is planning the erection of a foundry at Thirty-ninth and Wyncoop streets. Modern equipment will be installed.

The Bohm-Rugaard Rotary Engine Company, San Francisco, Cal., has been incorporated by E. A. Bohm, L. Rugaard and C. F. Kleegard, with a capital stock of $100,000.

Architect A. Howard Herman, Berkeley, Cal., is preparing plans for a commercial garage and repair plant to be erected at Berkeley. Modern machinery will be installed.

The Unity Manufacturing Company, Los Angeles, Cal., has leased property at Main and Macy streets, and will establish a plant for the manufacture of wood working machinery.

The Toppenish (Wash.) Iron Works will build an iron foundry and brass works addition to its plant. Modern equipment will be installed. J. C. Lockett is head of the company.

The Kain Fixture and Brass Works, West Ann street, Los Angeles, Cal., has taken out a permit to erect an addition to its metal-working plant. Leroy R. Kain is head of the company.

F. S. Granger, Fresno, Cal., plans for the erection of a coöperative commercial garage and repair plant at Fresno. Mr. Granger is interested in the Fresno, Hanford & Summit Lake Railway.

The Eugene (Ore.) Belt Line and Interurban Railway Company (electric), recently incorporated, contemplates the erection of car shops at South Eugene. P. C. Lavey, Eugene, is head of the company.

The California Automobile Company, Los Angeles, Cal., has leased property on West Seventh street, and will establish a commercial garage and repair plant. Modern equipment will be installed.

The East Davenport Machine Company, Davenport, Iowa, has been organized with $30,000 capital to manufacture traction ice harvesters. William Waters, president; John T. Campbell, vice-president.

The Braden Manufacturing Company, Hanford, Cal., has acquired the Newport garage. The company will erect a new building, and will fully equip with machinery for a modern automobile repair plant.

The Western Motor Car Company (L. M. Cregor, manager), San Diego, Cal., has leased property on Front street, and will establish a commercial garage and repair plant. Modern machinery will be installed.

The Durocar Manufacturing Company, Los Angeles, Cal., manufacturer of the Duro automobile, contemplates the erection of a plant for the manufacture of its car at Anaheim, Cal. Mr. Shaffer is general manager.

The Consolidated Manufacturing Company, Sunnyvale, Cal., plans for the erection of a plant for the manufacture of stoves, air-tight heaters, iceless refrigerators and kindred specialties. The plant will be fully equipped.

The Ingram Wheel Company, Phoenix, Ariz., has been incorporated by Joseph A. Ingram, A. A. Shroeder and J. L. Cutter with a capital of $35,000,000. The company will build a plant for the manufacture of automobile wheels.

The city of Seattle, Wash., has leased property on Fourth avenue, and will erect a garage and repair shop for the maintenance of the city automobiles. Modern equipment will be installed. The city building department is in charge.

In connection with the proposed additions and improvements in its plant, the Union Iron Works, San Francisco, Cal., has taken out a permit to build a new structural shop and ship foundry at a cost of $43,800. Modern machinery will be installed.

The Rose Oil Can Company, Bozeman, Mont., has been incorporated by Elias B. Rose and J. H. Dawes, with a capital of $30,000. The company plans for the estab-

lishment of a plant at Bozeman for the manufacture of a patented oil can.

The supply committee of the city council, Los Angeles, Cal., plans for the erection of a municipal garage and machine shop for the city automobiles, and for the establishment of a blacksmith and wagon repair plant for city work. Both plants will be fully equipped.

The Security Vault and Sheet Metal Works, East Main street, Portland, Ore., is having plans prepared for a new manufacturing and metal working plant near Kenton, Ore. The company makes a specialty of galvanized tubes. New machinery will be installed throughout.

The Santa Fé Railroad Company is planning to increase the capacity of its shops at San Bernardino, Cal. New machinery will be installed in the machine shops and other departments. A new blacksmith shop will be erected. It is estimated that $250,000 will be expended.

The National Co-Operative Farm Machinery Company, Davenport, Iowa, has been incorporated with $5,000,000 capital to manufacture traction engines, cotton pickers, etc. J. F. Appleby, one of the International Harvester Company's chief inventors, is one of the vice-presidents.

The Southern California Edison Company, Los Angeles, Cal., is having plans prepared for a garage to be erected on Wright street, Los Angeles, for the care and repair of its automobiles. The company has also taken out a permit for the erection of a similar garage plant at Pomona, Cal. Both plants will be fully equipped.

The Western Motor Truck Manufacturing Company, Seattle, Wash., recently incorporated, plans for the erection of a plant for the manufacture of gasolene and electric motor-driven commercial trucks. The plant will be fully equipped. H. W. Mix and R. O. Sayre are at the head of the company

CANADA

Tillsonburg, Ont., will equip a hydro-electric station.

The Cowan Company will equip a big new garage at Toronto.

The Beeton Watch Company will build a factory at Toronto.

The Disette Motor Company will locate a plant at Vancouver.

The Standard Silver Company will build a new factory at Toronto.

The Architectural Metal Company will locate a factory at Ottawa.

The Lurie Auto Company will equip a big new plant at Vancouver, B. C.

The Granby Hardware Company will build a new factory at Granby, Que.

R. & W. Kerr will build a new hardware-manufacturing plant at Montreal.

The Gurney Foundry Company, of Toronto, will build an addition to its plant.

Stephenson & Evans will build a new machine shop at North Battleford, Sask.

The blacksmith shop of John Manuel, St. Stephen, N. B., was destroyed by fire.

The Dominion Rock Drill Company, of Napanee, will build an addition to its factory.

The Canadian Northern railway will equip new shops, etc., at Quebec, to cost $300,000.

The Modern Garage Company will equip a big new garage and repair shops at Montreal.

The D. A. McIlroy Steel Company will build a new factory at Hamilton, Ont., on Lottride street.

J. H. Cole will locate a new factory for manufacturing drawn-wire products at Owen Sound.

Frank C. Knight will equip a large new garage and repair shops at 41 Purcell avenue, Winnipeg.

G. D. Membery & Sons, of 28 Severn street, Hamilton, will purchase new spring-making machinery.

The Owen Sound Bolt and Nut Machinery Company will locate a new factory at Owen Sound, Ont.

The Sherbrooke Ford Company will equip a big new garage and repair shops at Sherbrooke, Que.

The International Harvester Company will equip a new branch plant at Lethbridge to cost $100,000.

The garage and repair shops of Park & McVelty, at Ottawa, wiped out by fire, will be reequipped. Loss, $10,000.

The British Columbia Marine Railways Company will locate new machine, boiler and pipe shops at Esquimalt, B. C.

The Thomas Pink Company's machine shops at Pembroke, were destroyed by fire. Loss, $50,000. Will be rebuilt immediately.

The Steam and Radiation Company, of Toronto, will locate a branch foundry and machine shops at St. Catherines, Ont.

Fire did $15,000 damage to the stock and machinery of George Snow's garage, at Winnipeg. New equipment will be purchased.

The Steel Company of Canada is to extend its plant at Hamilton, Ont., by the erection of a rod mill, a blooming mill, a billet mill and two 60-ton continuous openhearth furnaces.

G. Cassady, Vancouver, B. C., connected with the Vancouver Cold Storage Company, is at the head of a company which plans for the establishment of a plant for the manufacture of a patented gas engine.

The British Columbia Marine Railway Company, Vancouver, B. C., is having plans prepared for a large dry dock plant at Esquimalt, B. C. The plant will comprise machine shops, boiler shops, metal working and pipe shops, and will be fully equipped. An electric power plant is also contemplated.

FOREIGN

Dr. Robert Grimshaw, Dresden A 16, Germany, will receive catalogs, etc., of melting furnaces, brass-working tools, etc., for a brass foundry which the Bavarian Government, Department of Mines and Manufactures, is installing.

GENERAL MANUFACTURING

NEW ENGLAND

Natick, Mass., will expend $5000 for the extension of its water system.

The Saco Valley Canning Company, Belfast, Me., will enlarge its plant.

Fire destroyed the sawmill and store houses of Arthur Rackliff, Farmington, Me.

New Britain, Conn., will issue $100,000 bonds for improvements to its water system.

The Acton Woolen Company, South Acton, Mass., is erecting an addition to picker room.

The Central Worsted Company, Central Village, Conn., will build an addition to its plant.

The Boston Woven Hose Company, Plymouth, Mass., is to change motive power to electricity.

The Lawton Mills Corporation, Plainfield, Conn., is to install electricity throughout its large plant.

The Standard Wash Tray Works, of New Haven, Conn., will build an addition to its plant on Stiles street.

The Tallyho Knitting Company, recently incorporated, will erect a two-story factory at East Douglas, Mass.

Boone Folding Box Company, 137 Cannon street, Bridgeport, Conn., will erect a three-story building, 25x50 feet.

The Eastern Manufacturing Company, of Bangor, Me., will erect a new pulp mill at plant in South Brewer, Me.

The laundry of Watson & Lynch, South Hadley Falls, Mass., was destroyed by fire. All machinery was destroyed.

The Asaph Merriam Company, South Acton, Mass., manufacturing piano stools, is in the market for multi-spindle drill.

Richard Dietz, Holyoke, Mass., has purchased a tract of land in Willimansett and will erect a large modern bakery.

The Boone Folding Box and Printing Company, of Bridgeport, Conn., will build a new three-story factory on Stillman street.

The wood and paper box factory of Fred J. Derry, Hobart street, Danvers, Mass., was destroyed by fire. Loss about $50,000.

The Dwight Manufacturing Company, Chicopee, Mass., is erecting a new six-story factory building. The concern manufactures sheetings, etc.

The Amherst Electric Power Station, Amherst, Mass., was damaged by fire. A large part of the equipment was destroyed or badly damaged.

The Pawtuxet Valley Dyeing Company, which recently took over the Pierce Woolen Mill, Providence, R. I., will equip the plant with new machinery for dyeing purposes.

The Jewett Piano Case Company, Leominster, Mass., has plans under consideration for the erection of a new factory building in addition to its plant on Cotton street.

The Hamilton Manufacturing Company, Lowell, Mass., making ticks, prints, etc., will replace mills Nos. 1 and 5 with modern structures. New equipment will be needed.

The C. H. Noone Company has been organized at Kittery, Me., for the manufacture of woolen and worsted goods. Charles H. Noone, president; Herbert A. Goodwin, treasurer.

Fred W. Richardson, Gardner, Mass., is at the head of a new company recently organized to manufacture a patented combination folding crib. A factory on Sherman street has been secured and will be equipped immediately.

W. H. Wiley & Son, Hartford, Conn., manufacturers of gaiters, leggings, etc., have purchased the two-story factory building on Pliny street formerly occupied by the McCue company, and will move its plant from North Main streets.

MIDDLE STATES

W. D. Halloway's flour mill, at Dover, Ind., was destroyed by fire.

The Somerville Iron Company, Somerville, N. J., will install a new boiler.

Con. Jensen, of Glenwood City, Wis., will erect a blacksmith and wagon shop.

The asphalt plant of the city of Pittsburg was destroyed by fire. Loss, $15,000.

Fire did $15,000 damage in the press room of *The Brooklyn Citizen*, Brooklyn, N. Y.

The city of Toledo, Ohio, is considering the erection of a municipal electric-light plant.

The Electric and Water Company, of Grand Rapids, Wis., plans to install a gas plant.

The New Process Rawhide Company, Plum street, Syracuse, N. Y., will enlarge its plant.

Oneida, N. Y., is preparing to erect a sewage-disposal plant. Work will begin next spring.

The Plymouth (Wis.) Brewing Company will erect a bottling house. J. E. Curtis in charge.

The Chicago (Ill.) Laundry Company will build a branch at 4243-45 Cottage Grove avenue.

The American Cheese Company, of Sheboygan, Wis., expects to erect a cold-storage plant next season.

The American Sheet and Tin Plate Company, Cleveland, Ohio, will erect a large boiler house.

The Lindow Brothers & Beers table factory, of Marine City, Mich., was destroyed by fire. Will be rebuilt.

The Lion Varnish and Shellac Works, 3560 Vincennes avenue, Chicago, Ill., will build a new $17,000 factory.

The Knickerbocker Ice Company will build a one-story ice factory at 638-46 West Sixty-fifth street, Chicago, Ill.

The Clark Pottery, at Crooksville, Ohio, is erecting an addition to its plant. William Clark is general manager.

Knell & Adams, automobile-body finishers, of Detroit, Mich., have acquired a new plant and will need equipment.

A new plant is being built on Louisa street, Pittsburg, Penn., for the Zemmer Company, manufacturer of chemicals.

The Sheboygan Evaporated Milk Company will erect a two-story addition to its plant at Jefferson, Wis., this spring.

The Indianapolis Cradle Works, of Indianapolis, Ind., manufacturer of cradles, is erecting an addition to its plant.

Contract has been let for the construction of a six-story factory for the Barnett Leather Company, at Little Falls, N. Y.

The Art French Dry Cleaning Company will build a new plant at Mitchell avenue and Carthage road, Cincinnati, Ohio.

The Toledo Fiber Package Company, of Toledo, Ohio, manufacturer of fiber packages and boxes, is to erect a new factory.

The Simmons Boot and Shoe Company, of Toledo, Ohio, manufacturer of boots and shoes, will erect a new factory.

The Square Realty Company, Cleveland, Ohio, will want power and other machinery equipment for a new large hotel.

The B. F. Goodrich Company, Chicago, Ill., is having a three-story building erected for the manufacture of rubber goods.

The Fountain City (Wis.) Brewery Company will improve its plant. Vandussen & Stevens, architects, Winona, Minn.

The Marinette (Wis.) Excelsior and Wrapper Company will erect a plant next spring. Aug. Habighorst, manager.

Quaker City Flour Mills have let contract for a four-story addition at Thirtieth and Market streets, Philadelphia, Penn.

Richardson & Weir will erect a large addition to their dye works at Jasper and Westmoreland street, Philadelphia, Penn.

Power-house and other equipment will be required for a broom factory to be erected for J. P. Sweitzer, Cleveland, Ohio.

Construction has been started on the large addition to the plant of the John G. Burley Pottery Company of Crooksville, Ohio.

The plant of the Burton Powder Company, at Lowellville, Ohio, including wheel mill, was partially destroyed by an explosion.

The Eagle Brewing Company, of Utica, N. Y., will erect a new building for its pumps and will install a new 175-horsepower boiler.

The sawmill of E. Packer & Co., at Sixteenth and Fitzwater streets, Philadelphia, was destroyed by fire. Loss, $35,000. Will rebuild.

An addition to cost $12,000 is to be built to the plant of the Eagle Ice Company, at Fifty-seventh and Hoffman streets, Philadelphia, Penn.

A two-story power plant will be built for the N. B. Hafleigh Company, on Philip street, south of Cambria street, Philadelphia, Penn. Cost, $5000.

A permit has been granted to the Petroleum Product Company for a two-story building at 3400 Grant boulevard, Pittsburg, Penn., to cost $17,425.

The Bergen Hygienic Ice Company, Brooklyn, N. Y., has been organized to manufacture ice, etc. Capital, $10,000. Incorporators, J. W. Maas, O. Jurgensen, J. J. Scully.

The Colfax Manufacturing Company, manufacturer of carriages, at South Bend, Ind., has purchased land in the southern part of the city and will erect a five-story factory.

A new central heating and lighting plant has been authorized for Tuskegee Institute, Tuskegee, Ala., at an estimated cost of $250,000. W. G. Franz, architect, Cincinnati, Ohio.

The Chicago (Ill.) Hosiery Mills Company has been organized to manufacture hosiery, etc. Capital, $15,000. Incorporators, Julius N. Heldman, W. M. Tannenbaum, Edward Graff.

a combined capacity of 24,000,000 gallons daily will be required, one of 17,000,000 gallons for the Torrence Road station, and one of 7,000,000 gallons for the Westerni Hills station.

The Kokomo Belt Company, Kokomo, Ind., has been incorporated to manufacture belts and suspenders. Capital, $20,000. Incorporators, Geo. D. Jones, E. K. Jones, J. Edward Wilson.

Power-plant equipment will be required for the electric railway to be built at Covington, La. W. J. Tracy, of Cleveland, Ohio, is head of the company. A franchise has been granted.

The Consolidated Light and Power Company, of Detroit, Mich., has purchased the plant of the Milling Light and Power Company, of Clare, Mich., and will increase its capacity.

The General Specialty Company, Indianapolis, Ind., has been incorporated with a capital of $40,000 by C. F., R. E. and W. W. Gregg and J. W. Coulter, to manufacture automobile tires.

The Otterbein Light and Power Company, Otterbein, Ind., has been incorporated with a capital of $10,000 by R. H. Holt, Louis Leaming and R. W. Pierce to manufacture and sell electricity.

The Dresden Mill Company, Dresden, Ohio, has been organized with $15,000 capital to do a general milling business by T. P. Perkins, L. C. Gray, J. H. Taylor, L. H. Howell and F. C. Somerville.

The Anderson Valley Lumber and Spoke Company, St. Meinrod, Ind., has been incorporated with a capital of $7000 by J. A. Greulich, N. A. James and others, to do a manufacturing business.

A permit has been granted for the erection of a $61,000 factory for the John T. Bailey Company, at the corner of Water and Tasker streets, Philadelphia, Penn. The concern manufactures cordage, etc.

U. S. Gas and Electric Sign Company, Chicago, Ill., has been organized with $15,000 capital to manufacture and deal in gas and electric signs, etc. Incorporators, John Stelk, Nels H. Olson, Frank H. Bicek.

The Lewiston & Lake Ontario Shore Power Company has applied to the Public Service Commission, of New York State (second district) for franchises in Lewiston and Youngstown. Substations are proposed at Lewiston, Youngstown and Ransomville.

Bids will be received at the office of the director of public service, 104 City Hall, Cleveland, Ohio, until December 7, 1911, for furnishing air-compressor equipment for the Kirtland pumping station of the water department. Specifications may be obtained of the superintendent of the Water Department, Cleveland, Ohio.

SOUTHERN STATES

Adams, Payne & Gleaves, Roanoke, Va., have commenced the erection of a new planing mill.

Frederick Bauernschmidt, Baltimore, Md., will erect a large addition to his bottling plant and brewery.

The Standard Lime and Storage Company plans to erect a large plant on the old quarrantine grounds in Baltimore, Md.

The Terminal Freezing and Heating Company will erect a large addition to its plant on South Eutaw street, Baltimore, Md.

New machinery will be required in the cotton duck mill at Laurel, Md., which has been leased by the American Ramie Company, from the Consolidated Cotton Duck Company, of Baltimore.

WEST OF THE MISSISSIPPI

The Mitchell (S. D.) Silo Company will build a $25,000 plant.

Marks & Hensley, of Bertram, Ia., will erect new cement block factory.

Garlie & Brasten, of Glenwood, Minn., will erect new carriage and cutter factory.

The Denver (Colo.) Terra Cotta Company has taken out permit to erect new plant.

The Farmers Handy Wagon Company, Des Moines, Ia., will build an addition to plant.

Work has been started on the new plant for the Iowa wagon factory at Sioux Falls, S. D.

J. E. Morroe, Denver, Colo., will build a laundry at Twentieth and Washington streets.

The North Star Mines Company, Nevada City, Cal., will install new electric pumping machinery.

The city of El Centro, Cal., will make improvements and additions in its waterworks system.

Elma, Wash., is asking for bids for the construction of a waterworks system and pumping plant.

The Commercial Club at Laurel, Mont., has arranged for the establishment of an $11,000 alfalfa mill.

The shingle mill plant of Warren Parker, North Bend, Ore., was destroyed by fire. The plant will be rebuilt.

The city of Canyon City, Ore., plans for the installation of a waterworks system. Bonds will be voted.

The Chino Copper Company, Santa Rita, N. M., is building a new electric power plant. The plant will be fully equipped.

The blacksmith and wagon shop of the Hanim Brewery Company were burned at St. Paul, Minn. Loss, $14,500.

The Tracy Engineering Company, Phoenix, Ariz., plans for the erection of an electric power plant on the Colorado river.

The plant of the A. I. Root Printing Company, Thirteenth and Howard streets, Omaha, Neb., was burned. Loss, $175,000.

The city of Amity, Ore., contemplates the installation of a waterworks plant and system. The city council is in charge.

The city of Venice, Cal., plans for the installation of a modern garbage incinerator plant. The city engineer is in charge.

The city of Seaside, Ore., contemplates the installation of a modern waterworks system. Bonds for $150,000 will be voted.

T. Williams and S. C. Hart, Terra Bella, Cal., plan for the installation of a modern pumping plant on property near Terra Bella.

The Lemon Grove (Cal.) Fruit Growers' Association has acquired a site and plans for the erection of a modern fruit-packing plant.

R. J. Bunnell, Stratford, Wash., has acquired property near Stratford, and contemplates the installation of a pumping plant.

A new coöperative creamery will be erected at Lemmon, S. D. F. A. Fuich, E. B. Evenson, C. D. Smith and J. C. Elliott interested.

The Northern Idaho & Montana Power Company, Kalispell, Mont., will install an electric-lighting system at Kalispell and vicinity.

The Leland Stanford University, Stanford University, Cal., will erect a new electric power plant. The board of trustees is in charge.

The sawmill and shingle mill plant of A. D. Bryan, Clover Flat, near Lakeview, Ore., was destroyed by fire. The plant will be rebuilt.

The Carlton (Ore.) Mutual Telephone Company plans for the installation of a plant and system at Carlton. A franchise has been granted.

W. R. Fleming, Mason City, Iowa, contemplates the erection of a grain-milling plant at Three Forks, Mont. Modern machinery will be installed.

The Columbia Engineering and Construction Company, Wenatchee, Wash., will install a large pumping plant on property in the Wenatchee valley.

The Coöperative Company will erect new creamery at Elkton, S. D. A. J. Quinn, president; O. W. Marshall, secretary; W. S. Rosburg, treasurer.

The pumping plant of Reclamation District No. 3, at Ryde, near Sacramento, Cal., was destroyed by fire with a loss of $50,000. The plant will be rebuilt.

The International Crayon Company, Spokane, Wash., manufacturer of chalk and crayon products, has taken out a permit to build a plant on Cook street.

David H. Ryan, Portland, Ore., has taken out a permit to build a new laundry plant on East Forty-third street. Modern equipment will be installed.

H. B. Burns, Fifth street, San Diego, Cal., has taken out a permit to build a fruit packing plant near San Diego. Modern equipment will be installed.

The Independent Meat Market, Phoenix, Ariz., is having plans prepared for the rebuilding of its plant. New refrigerating machinery will be installed.

The Randolph Fruit Company, Lemon Grove, near San Diego, Cal., will build an addition to its fruit-packing plant. New machinery will be installed.

The New State Construction Company, Parker, Ariz., plans for the erection of a telephone plant and system at Parker. W. H. Tharpe is general manager.

The Western Tanning Company, Denver, Colo., is said to be planning for the erection of a modern tanning plant at San Diego, Cal. V. K. Sturgess is in charge.

Power-plant equipment will be installed in the new hotel to be erected by T. A. Marlow and others, Helena, Mont. The structure is estimated to cost $400,000.

The Marion Mining Company, Searchlight, Nev., will install new electric hoisting machinery. The company plans to have its entire plant electrically operated.

The Centralia (Wash.) Light and Traction Company has commenced the erection of a new electric power station near Centralia. The plant will be fully equipped.

The Steamboat Springs Mining and Development Company, Reno, Nev., plans for the erection of a large central boiler plant. J. W. Hopkins is head of the company.

The Strathmore (Cal.) Citrus Association will make improvements and additions in its fruit-packing plant. New machinery will be installed. E. D. Dyer is manager.

The lumber working plant of the Somers (Mont.) Lumber Company, recently destroyed by fire, will be rebuilt and new machinery installed. W. E. Wells is manager.

The Puyallup & Sumner Fruit Growers' Association, Puyallup, Wash., contemplates increasing the capacity of its fruit-canning plant. An addition will be erected.

The Alsea (Ore.) Coöperative Creamery Association has been organized, and plans for the construction of a creamery plant. Modern machinery will be installed.

County Commissioner Barnes, Goldendale, Wash., contemplates the installation of an isolated electric power plant on his farm on the Little Klickitat creek, near Goldendale.

The Western Utilities Company has purchased the plant of the Ottumwa (Iowa) Gas Light, Heat and Power Company and will make extensive improvements to same.

The city of Redlands, Cal., has engaged engineer F. E. Trask, Laughlin building, Los Angeles, Cal., to prepare plans and specifications for its proposed municipal waterworks.

The Ashland (Ore.) Fruit and Produce Association plans for the erection of a new fruit-packing plant. A precooling plant will be installed. The plant will be fully equipped.

The University of Arizona, Tucson, Ariz., has acquired property at McNeal near Douglas, Ariz., and plans for the installation of a large pumping plant. Mr. Blalock is in charge.

The boiler plant, engine room, grape-crushing machinery and other equipment of the Elk Grove (Cal.) Winery were destroyed by fire. Loss estimated at $30,000. The plant will be rebuilt.

The Builders' Supply Company (O. K. Palmer), Chehalis, Wash., plans for the erection of a plant for the manufacture of woodbuilding specialties. Modern machinery will be installed.

The Coalinga (Cal.) Water and Electric Company plans for the installation of an electric power system in the Pleasant Valley district, to furnish power for electric pumping machinery.

The Siskiyou Electric Light and Power Company, Yreka, Cal., will install an electric-lighting system at Dorris, Cal. A franchise has been granted. J. W. Churchill is president of the company.

The Coöperative Fruit Growers' Association, Riverside, Cal., has taken out a permit to build an addition to its fruit-packing plant on East Arlington avenue. Modern equipment will be installed.

The Vanadium Mines Company, Cutter, N. M., plans for the erection of a new power plant on its properties. About $20,000 will be expended. W. A. Bonitz, Pittsburg, Penn., is head of the company.

The Southern Sierra Power Company, San Bernardino, Cal., plans for the erection of a large electric power plant in the Sierra Nevada mountains, Kern county, Cal. Delos A. Chappell is head of the company.

The Reno (Nev.) Mill and Lumber Company has acquired the Portola (Cal.) Light and Power Company. The new owners plan for the erection of a hydroelectric power plant on Grizzly creek, near Portola.

The Sammis Monumental Works, Division street, Spokane, Wash., plans for improvements and additions to its stone- and marble-working plant. New equipment will be installed. About $40,000 will be expended.

The J. Niederer Company, Main street, Los Angeles, Cal., manufacturers of hardwood bank and office fixtures, is having plans prepared for an addition to its wood-working plant. Modern equipment will be installed.

CANADA

Scott, Sask., will equip a new waterworks system.

Exeter, Ont., will equip a hydroelectric station.

Victoria, B. C., will build a new waterworks plant.

Virden, B. C., will equip a new light and power plant.

Watertown, Ont., will equip a new hydroelectric station.

Moose Jaw, Sask., will purchase a new steam pumping engine.

Hon. H. A. Short, of Calgary, will build a big new brewery there.

The Carson Creamery Company will equip a modern plant at Winnipeg.

Brockville, Ont., will purchase additional waterworks pumping machinery.

The J. H. Ross Boat and Canoe Company will equip a new plant at Orillia, Ont.

Drummondville, Quebec, will purchase new power machinery, generator, waterwheel, etc.

Important extensions will be made to the Berlin Electric Lighting Plant at Berlin, Ont.

An $80,000 power house will be equipped in connection with the Windsor hotel, at Montreal.

Logan Brothers, Ltd., of Renfrew, will buy a large quantity of the latest woolen mill machinery.

Henderson Black & Connors will build an addition to the binder-twine factory at Walkerton, Ont.

The Robinson Cork Company will build a big extension to its factory at Port Colborne, Ont.

The Canadian Hart Emery Wheel Company will build a big addition to its factory at Hamilton.

The flour mill and planing mill of R. O. Konkle, at Beamsville, Ont., was burned. Loss, $9000.

The Dominion Shale Brick and Sewer Pipe Company will locate a new plant at Vancouver, B. C.

Grant Smith & Co. will equip a $500,000 power plant on the Pundleget river, near Vancouver, B. C.

The Attachable Player Action Company will equip a new factory at Clinton, Ont. D. S. Cluff, Clinton.

The Portage La Prairie Brick and Tile Company will locate a new plant at Portage La Prairie, Manitoba.

The Canadian Collieries will spend $1,000,000 on new equipment for developing its property on Vancouver island.

MINING

Senator W. A. Clark will rebuild the concentrator burned at South Butte, Mont.

Plans are being prepared for a 300-ton mill to be installed at the Commonwealth mine, at Pearce, Ariz.

The Garthby Copper Mining Company will purchase machinery for developing its property at Garthby, Que.

A cyanide plant is to be erected at the Sterling mine, in Siskiyou county, Cal. E. M. Fondray is superintendent.

The Martin Porcupine Mines Company, of Toronto, will buy equipment for extensive development work on its properties.

The Digby Dome Mines Company, of Brantford, will purchase a large quantity of machinery for developing its property.

The Scottish Ontario Gold Mining Com-

pany, of Toronto, will purchase machinery for developing its plant. J. S. Emery, manager.

The Seneca Porcupine Gold Mining Company, of Toronto, will purchase machinery for developing its property. R. McKay, Toronto, manager.

The King Quicksilver Mining Company will buy equipment for a big new plant to be located in northern Ontario. W. N. Ferguson, Toronto, manager.

The company owning the Ibex and Mayfield claims, near Valdez, Alaska, is considering the erection of a stamp mill. M. M. Reese is president.

The Black Range Custom Reduction Works will enlarge its plant at Fairview, Ariz., to 100 tons capacity and will require additional machinery, including an aërial tramway.

The 10-ton concentrating and amalgamating mill at the La Cruz mine, in the Ocampo district, Chihuahua, Mexico, will be enlarged in the near future. A. D. Robinson, manager.

The hoisting plant and operating machinery of the Alaska mine, near Pike, Cal., were destroyed by fire. Loss estimated at $100,000. The plant will be rebuilt. George P. St. John is manager of the property.

The Washington Union Coal Company, Centralia, Wash., plans for additions and improvements in its coal mining plant at Tono, near Centralia; about $200,000 will be expended. The company will also build an electric power plant at its property to cost $250,000.

Trade Catalogs

The G. A. Gray Company, Cincinnati, Ohio. Catalog. Planers. Illustrated, 46 pages, 6x9 inches.

J. A. Stowell Company, Leominster, Mass. Circular. Saxon improved surface grinder. Illustrated.

Morse Chain Company, Ithaca, N. Y. Bulletin No. 11. Morse silent chain. Illustrated, 16 pages, 6x9 inches.

The Billing & Spencer Company, Hartford, Conn. Catalog. Drop-forged machine wrenches. Illustrated, 54 pages, 5x7 inches.

Challenge Machine Company, Inc., 5116 Springfield avenue, Philadelphia, Penn. Folder. Challenge five-in-one grinder. Illustrated.

Reynolds Pattern and Machine Company, 101-103 Third avenue, Moline, Ill. Circular. Reynolds automatic screw driver. Illustrated.

Stark Tool Company, Waltham, Mass. Catalog. Precision bench lathes, profiling machine, pinion and wheel cutter, etc. Illustrated, 42 pages, 6x9 inches.

American Air Compressor Works, 26 Cortlandt street, New York. Catalog No. 19. Fairhurst air compressors, vacuum pumps, etc. Illustrated, 30 pages, 6x9 inches.

Brown & Sharpe Manufacturing Company, Providence, R. I. Six booklets. Grinding and grinding machines. "In the Shops Where B. & S. Grinding Machines are Built," "Accurate Grinding is Largely Due to Alignments of Machine," "Why Independent Speeds and Feeds are Essential in Grinding Machines," "Rigid Machine Tool Construction—Its Value in Grinding Machines," "Features that Adapt B. & S. Machines to Commercial Grinding" "Points about Grinding Wheels and Their Selection." Illustrated.

Forthcoming Meetings

American Society of Mechanical Engineers, annual meeting, December 5 to 8, New York City. Calvin W. Rice, secretary, Engineering Societies building.

Society of Automobile Engineers, annual convention, New York City, January 18-20, 1912. C. F. Clarkson, general manager, 1451 Broadway, New York City.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month. Hotel Bellevue. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North,

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

Calipers: Welles Caliper Co., Milwaukee, Wis.

Test indicators. H. A. Lowe, Cleveland, O.

Sachs' standardized tool requisitions: mechanical drawings. J. J. Sachs, Lynchburg, Va.

We buy or pay royalty for good patented machine or tool. Box 282, Amer. Machinist.

Wanted—Work for screw machines and gear cutter. Box 775, American Machinist.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Machinery built to order; modern plant; 30 miles from New York. Box 335, Amer. Machinist.

We build to order light machinery, tools, jigs, subpresses and dies; high-grade work. The Elgin Tool Works, Elgin, Ill.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Autogenous welding of broken cylinders and crank cases is most expertly done by Waterbury Welding Works, Waterbury, Conn.

Who manufactures in large quantities, auto rivets, bored and hardened; offers under Ke. 2381, to Rudolf Mosse, Elberfeld, Germany.

Draftsmen—Get a copy of "Dimensions of mechanical and general designing. E. Smith Company. Box 655, American Machinist.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Tool tempering chart, printed in colors with full description; 13½x9½ inches; 10 cents postpaid. Spon & Chamberlain, 123 Liberty St., New York.

Wanted—High grade machine work in quantities for gear cutters, hand turrets, milling machines, etc. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Draftsmen—Get a copy of "Dimensions of Pipe, Fittings and Valves," 75 cents; slightly soiled copies, 50 cents. National Book Company, Collinwood, O.

A successful manufacturing inventor requires necessary capital to develop and handle line of profitable small tools and specialties. J. H. Knight, Westtown, Penn.

New patented threading tool, positively best ever invented, produces better results than any on market; will sell patent, or royalty. Box 675, American Machinist.

Active, hustling business man would invest $5000 to $10,000, with services, for half interest in going concern with money making possibilities. Box 650, Amer. Mach.

Small shop holding valuable automatic machine tool patents, desires machinery agency to finance expansion necessary for manufacture and sale of same. Box 620, Am. Mach.

We are frequently needing good operators for turrets and gear cutters, principally Jones & Lamson and Gleason, and invite applications. Frost Gear and Machine Company, Jackson, Mich.

Simple, meritorious inventions bring profits, often fortunes; mail description of your invention for free, candid opinion and estimate to apply for patent. E. P. Thompson, M. E., Victor Bldg., Washington, D. C.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, Amer. Mach.

A strong, old established manufacturing company, with a national selling organization, wants to add a new line of building material or construction specialty to manufacture and sell. Address "X," Box 617, Am. M.

Technical patents are best taken care of by an engineering patent attorney, with sound practical experience, both as an engineer and as an attorney; highest references. G. M. Sacerdote, M. E., and Reg'd Patent Attorney, 1919 Broadway, New York City.

Machinists, toolmakers, new vest pocket book, most needed rules, tables, general and economic information; list of shops; 16 colored maps; blank memoranda; 120 pages; in leather finished covers, 35 cents. William Cuthbertson, 39 Springside avenue, N., Pittsfield, Mass. Agents wanted.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Company, Inc., 40 West 13th St., New York City.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CANADA

Superintendent for machine screw shop in Canada, man with selling ability; state experience and salary expected. Box 615, American Machinist.

INDIANA

Wanted—Electrical instrument maker for experimental work, steady position. Remy Electric Co., Anderson, Ind.

Wanted—Foreman for automobile road testing department; technical man preferred; state salary expected. Box 665, Am. Mach.

Superintendency of an automobile plant or similar position; thoroughly competent and fully understands time study and rate setting; also standardizing of operations and shop organizing by a thorough mechanic in all branches; particulars on receipt of inquiry. Box 662, American Machinist.

MASSACHUSETTS

Draftsman, experienced on web feed printing presses. Meisel Press & Mfg. Co., 944 Dorchester Ave., Boston.

Wanted—For concern manufacturing small interchangeable quantity work, general foreman to supervise production in tool, automatic screw machine and other shop departments; must be a practical man with actual experience on modern machine tools, able to operate any machine tool, and familiar with rapid production under piece rate system; steady position to energetic man with ability to efficiently handle men; in your reply state age, nationality, experience, places and periods of employment and salary expected. "F," Box 1574, Springfield, Mass.

NEW JERSEY

Wanted—Man to take care of card records, stock list and order systems in drawing room; must be good penman, rapid and absolutely reliable; good position for right party. Saurer Motor Co., Plainfield, N. J.

Metallurgist, by a company located vicinity New York City; must understand thoroughly analysis of iron and steel; also heat treatment of same, and physical testing work; exceptional opportunity for capable party. Box 622, AMERICAN MACHINIST.

Wanted—By a large manufacturing company in New Jersey, a young man as assistant foreman in machine shop; good position for the right man; in applying, state age, experience and salary expected. Apply "H," Box 552, AMERICAN MACHINIST.

Draftsmen—Competent men with broad experience in mill-building construction, power plant design and general engineering, wanted at once by large industrial plant near New York City; full particulars as to experience, age, salary and references required. Box 596, AMERICAN MACHINIST.

NEW YORK

Wanted—An energetic young man having experience in production end of shop doing fine work; unusual opportunity for tactful, capable man. Write, giving references. Box 674, AMERICAN MACHINIST.

Wanted—Chief draftsman acquainted with crane and hoist construction; one who can give positive evidence of ability, can secure permanent and satisfactory position. Address Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

Wanted—Foreman to take charge of machine shop doing a general line of moderately heavy work; to qualify one must be thorough mechanic, used to uptodate tools and machines, able to handle about 75 men, and get results promptly; residence in town where shop is located imperative; location 12 miles from New York City; state experience fully, age and salary expected. Box 651, AMER. MACHINIST.

OHIO

Wanted—Designer and draftsman who is thoroughly familiar with presses, shears and special machinery. Box 561, AMER. MACH.

Wanted—A first-class machine tool salesman, preferably a man with technical, shop and commercial experience. Box 652, AM. M.

Wanted—Machine shop foreman; medium and heavy work; seventy-five to one hundred men; must have good judgment, be acquainted with best modern shop practice, and be able to reduce costs; state age, references and salary; permanent. Box 597, AM. MACH.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, milliwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Wanted—A manufacturer of engines and boilers wants a foundry foreman; employing 40 to 50 molders and coremakers. Address "Manufacturer," AMERICAN MACHINIST.

Wanted—Draftsman experienced on machine tool work, and capable of designing tools and fixtures; state age, salary and references. Box 645, AMERICAN MACHINIST.

Machine designers wanted; one experienced on small automatic grinding machinery preferred; state experience and wages expected. Standard Roller Bearing Company, Philadelphia, Penn.

Working superintendent, familiar with pneumatic tools to take entire charge of factory; good opportunity for right man; state salary and references in own handwriting. Box 666, AMERICAN MACHINIST.

Wanted—Tool steel salesman; must thoroughly understand selling and demonstrating steel; unusual opening for A-1 man; knowledge of Middle States territory preferred. Box 621, AMERICAN MACHINIST.

Bilgram gear generator operator wanted, experienced on cutting automobile bevel drive gears and pinions; only thoroughly competent men need apply; state experience and wages expected. Standard Roller Bearing Company, Philadelphia, Penn.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Wanted—Situation as superintendent or assistant manager with growing concern, by man who has and is making good. Address "Machinist," Box 657, AMERICAN MACHINIST.

Designer, would like to communicate with a concern having open a permanent position for a first-class man with ten years' practical shop and office experience on jigs, fixtures and special machinery. Box 614, AMER. MACH.

DELAWARE

Technical graduate, eight years' experience working up new processes, having had charge in both drawing room and shop; go anywhere. Box 661, AMERICAN MACHINIST.

ILLINOIS

Uptodate mechanical engineer and expert is open for engagement after February next; 25 years' experience in designing and superintending manufacture of small high-class machinery, tools and fixtures. Box 673, AMERICAN MACHINIST.

MASSACHUSETTS

Designer of automatic machinery, jigs, fixtures, dies, etc.; practical mechanic, good executive with broad experience, desires responsible position; salary, $200 monthly. Box 624, AMERICAN MACHINIST.

Tool job foreman or assistant superintendent, 37 years old, 20 years' shop work, 8 with one firm, thorough mechanic and teacher; specialty, good work at right cost; at liberty January 1. Box 656, AMERICAN MACHINIST.

MINNESOTA

Superintendent, experienced in modern machine shop practice, specialist on tools and methods for reducing costs; tactful with men. Box 663, AMERICAN MACHINIST.

MISSOURI

Graduate civil engineer with three years' experience in structural work and three years in general machine design, man of thoroughness and ingenuity, desires change; would accept position of responsibility with consulting engineer. Box 646, AMERICAN MACHINIST.

NEW JERSEY

Mechanical engineer, expert machine designer, desires position. Box 628, AM. MACH.

Designer, experienced on automatic machinery, dies, tools, etc., wants position. Box 483, AMERICAN MACHINIST.

Wanted—Position as general foreman or foreman; 10 years' experience as foreman and master mechanic; good executive; best references. Box 664, AMERICAN MACHINIST.

Magneto or similar manufacture; advertiser has long and varied experience production end, modern methods; responsible position sought with good firm. Box 671, AM. M.

Advertiser, 20 years' experience accurate manufacturing oil, steam, petrol and gas engines, seeks opportunity with progressive firm; can get work out right, in quality and quantity. Box 670, AMERICAN MACHINIST.

Mechanical engineer, technical graduated in Germany, 25, with six years' experience in combustion engines and general machinery manufacturing, best references, wishes responsible position. Box 672, AMER. MACH.

Automobile trade, engines, gear boxes, axles or complete chassis; advertiser well acquainted production, all details; wide European experience; position sought as superintendent, departmental chief, assistant superintendent. Box 669, AMER. MACHINIST.

Position wanted with gas engine manufacturer who wishes to add to his force a man of wide experience in the marine gas engine field; has held responsible positions in the gas engine and in other lines of mechanical business; is at present employed as superintendent in shop employing 25 men but wishes to make a change where opportunities of advancement are greater. Box 648, AMERICAN MACHINIST.

NEW YORK

Experienced designer of Diesel oil engines desires position. Box 557, AMER. MACH.

Draftsman, mechanical, wishes position; technically educated; three years' combined office and shop experience. Box 676, AM. MA.

Draftsman—Young man, ten years' successful experience, reliable, accurate, inventive ability; A1 references. Box 637, AMERICAN MACHINIST.

Draftsman, ten years' practical experience; executive ability and originality; specialist automatic and paperworking machinery. Box 636, AMERICAN MACHINIST.

Designer and chief draftsman on automatic and special machinery for paper and board manufacturers; excellent references from present employers; shop and technical experience. Box 644, AMERICAN MACHINIST.

A class draftsman and designer; year's experience designing special and automatic machinery; bookbinders and paper receptacle machinery a specialty; New York City or vicinity preferred. Box 668, AMER. MACH.

Foreman—Young man, experienced as all-around machinist, expert on lathe, now acting as foreman of lathe and boring mill work, desires to change; best references as to character and ability. Box 677, AMER. MACH.

Chief draftsman, expert practical designer of special machinery, tools and dies, wishes responsible and executive position where originality and experience in modern shop and office methods are required. Box 633, AMERICAN MACHINIST.

Die casting superintendent desires change; 15 years' experience, all branches; exceptional executive ability; energetic, progressive, systematic, resourceful, reliable, expert, alloys, dies, casting machines, marked sales ability. Box 640, AMERICAN MACHINIST.

PENNSYLVANIA

Young man, age 22, Williamson Trade School graduate, employed as toolmaker, desires to make change, where by hard conscientious work, he can advance to responsible position. Box 667, AMER. MACHINIST.

Capable superintendent, experienced on accurate interchangeable production, aggressive, organizer and systematizer, practical on modern methods, making good at present, but desires change; location immaterial; good references. Box 660, AMERICAN MACHINIST.

Superintendent; efficiency man for interchangeable machinery, moderate sized plant; handles men, reduces costs, turns out the work; 19 years' experience with first-class concerns, designing, cost figuring, systemizing; personal details and references by letter. Box 653, AMERICAN MACHINIST.

RHODE ISLAND

Competent mechanical engineer, graduate, five years' experience, open for engagement January 1; good systematizer; able executive and superintendent. Box 577, AM. MACH.

FOR SALE

For Sale—Small well equipped general machine shop in New York City; good locality. Box 647, AMERICAN MACHINIST.

For Sale—Brass foundry, located on the Central Railroad of New Jersey. Address "Good Investment," AMERICAN MACHINIST.

For Sale—Patterns, drawings, patent and good will of internal grinding machine; an unusual machine in both design and capacity; a bargain; easy terms. "H," Box 658, AMER. MACHINIST.

For Sale—A sound, profitable, established tool manufacturing business can be bought; highest grade products; world wide trade, $150,000 cash required; balance secured; great opportunity, correspondence confidential. "Tools," AMERICAN MACHINIST.

For Sale—Complete machine shop equipped with No. 2 Kempsmith milling machine, 30-inch Cincinnati shaper, 26-inch Barnes drill press, 12-horsepower gas engine, sensitive drill press, emery grinder and small tools; sold complete or in part. Address "X," 534 Walnut street, Meadville, Penn.

For Sale—Within 60 miles of New York City a splendidly equipped modern manufacturing machine shop; work about 60 hands; equipped for all classes of light machine building; tools in perfect condition, and include both automatic and hand screw machines; price very reasonable; an established trade and good reasons for selling; building can be rented at a moderate figure, including light and power; best of shipping facilities. Address Box 654, AMERICAN MACHINIST

Talks With Our Readers

By The Sales Manager

AMERICAN MACHINIST, N. Y.
Dear Sirs:
I have been a subscriber to the AMERICAN MACHINIST for the past 15 years and secured two executive positions. Recently I advertised for a tool designer for our Machine Shop. I got 150 replies and selected one. Furthermore, I use the AMERICAN MACHINIST exclusively for quality help, wherever I have a vacancy.

Very truly yours,
E. KIBEL
Superintendent.
HENRY R. WORTHINGTON,
Harrison, N. J.

AMERICAN MACHINIST,
New York.
Gentlemen:
Two weeks ago tomorrow I answered an advertisement in your magazine and I have not received any reply.

This is the third advertisement I have answered without receiving a reply in a single instance.

Some of my friends say they are fake ads., but I can hardly believe that. It is possible that there is some mistake on my part, but be that as it may, will you kindly try to set me right in the matter.

The adv. I answered was in the issue of August 10th under the division of Indiana.

A gear cutting foreman was wanted and the address was BOX 111, AMERICAN MACHINIST. Thanking you for your trouble, I am,

Yours very truly,
(Name reserved)
Chelsea, Mich.

AMERICAN MACHINIST,
New York.
Dear Sirs:
I wish to mention the fact that through answering one of the ads. in your weekly paper that I now have a new position. I have just received word from the Cambpell Motor Co., of Wayzata, Minn., to start the 25th as foreman of their marine engine shop.

I am going to do my level best with the Campbell Motor Co. and prove to them that men hired through the AMERICAN MACHINIST are all right.

Yours truly,
DAVID MARCHANT.
MOLINE, Ill.

Every advertisement in the AMERICAN MACHINIST—classified and display—is absolutely bona fide.

No advertising is accepted from any agency, association or individual charging a fee for "registration" or a commission on wages of successful applicants for situations.

No advertisement for men can appear unless we first know the name of the shop where there is a vacancy.

Some dissatisfaction is caused by the use of blind addresses—having replies sent to a box number in our care. This is a convenience to the advertiser which is entirely legitimate. It prevents annoying telephone calls, saves the time of the manager interviewing applicants until he is ready to do so, and prevents before-hand-knowledge of contemplated changes and additions.

But there is really no excuse in these days of typewriters and manifolding processes of the too common practice of not acknowledging replies.

Advertisers who will put themselves for the moment in the applicant's shoes will acknowledge all replies. Business courtesy demands it.

* * *

The country's representative and progressive machine-building and using concerns—

And only the best class of mechanics—

Read and use the AMERICAN MACHINIST. It's the great clearing house of the machine-making industry.

* * *

Only reliable products can be continuously advertised.

The Mechanic and the Panama Canal

By Fred H. Colvin

A general description of the work being done on the Panama canal and the conditions which exist in the canal zone. With these understood, the articles to follow will be more intelligible and more interesting.

Many more notes of historical and general interest might have been added, but only a brief outline is given to show why so much machine work is necessary and why the mechanic is playing a more important part than has been generally understood.

We have become so accustomed to thinking of the Panama Canal as being entirely a civil engineering work that we have quite overlooked the mechanic and the important part that he has played and is still playing in its construction. I have no wish to take away one single glimmer of glory from the civil engineer for he deserves more than he will ever get. No one who is not somewhat familiar with the tropics can appreciate the work of the sanitary department in making the Canal Zone not only liveable but even attractive, in places where it was necessary to cut away the jungle in order to find houses and even small settlements shown on the French maps. And they have succeeded so well that many of the workers now in the Zone will not be satisfied with the living conditions in many of our manufacturing towns at home.

To appreciate all this we should not forget that de Lesseps' chief engineer died of yellow fever in less than three weeks after the party landed and that now the death rate on the Canal Zone is only half that of New York City. This, however, must not be taken as a fair comparison as the men and women are for the most part in the prime of life and the percentage of children is comparatively small, although they seem very healthy. Then too, as one of the engineers remarked, they have very few automobiles in the Canal Zone.

But the mechanical engineer and the machinist have been overlooked entirely in the accounts of the canal work so that it becomes my purpose and pleasure to accord these men some small measure of the credit they deserve. "Making the dirt fly" makes a good headline in the popular magazine or daily paper, but keeping it flying is quite another matter and is only made possible by the mechanical department.

First of all it is well to consider that, in a general way it was necessary to cut out an entire valley between two small mountains, Golden hill and Contractors hill, to make the celebrated Culebra cut, and to build an artificial hill at Gatun. For the Gatun dam, which has been "cussed" and discussed so frequently and so learnedly by those who have never seen it, is simply an artificial hill, 115 feet high and over a half mile thick at the base. It is so unlike the usual idea of a dam when seen in reality that all question of stability disappears unless an unprecedented upheaval or disturbance takes place.

The Locks at Gatun

Although concrete work is not exactly in the machinist's line, he is interested in the forms by which they are poured, and the enormous quantities of

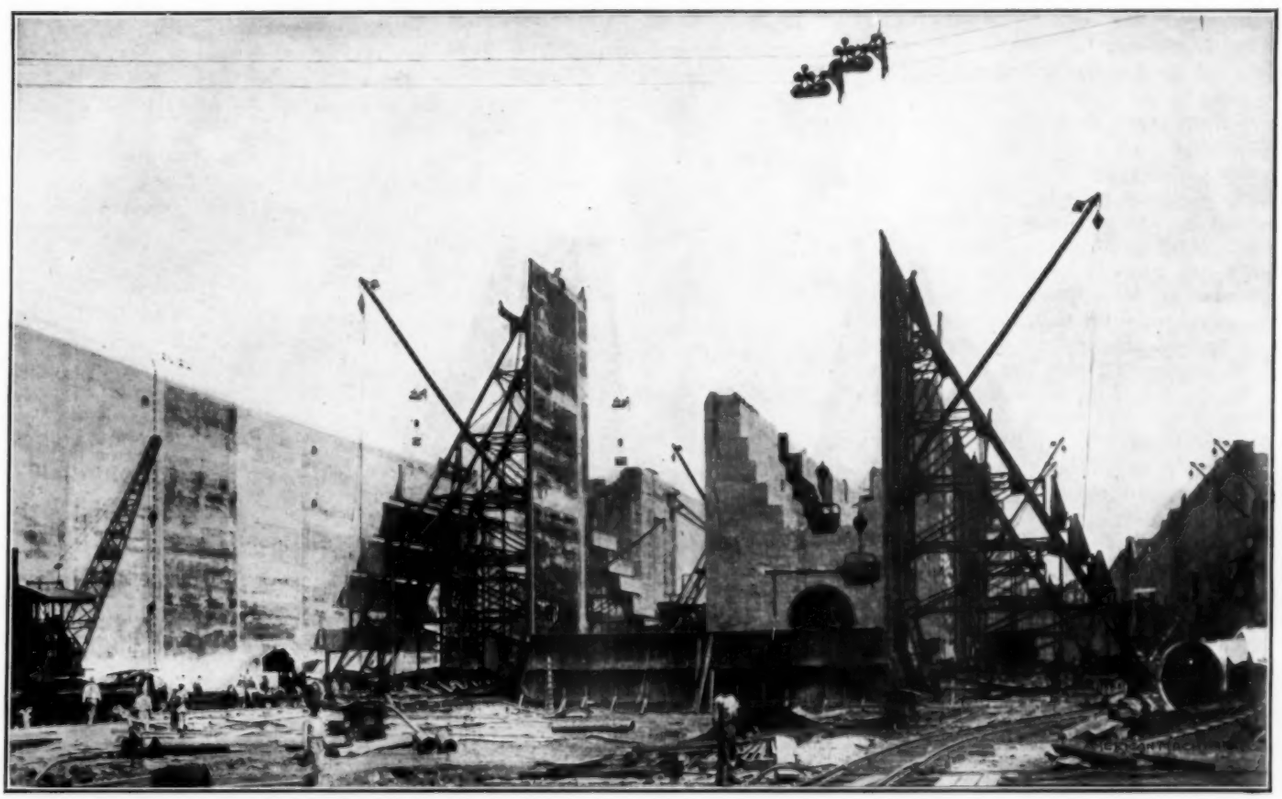


Fig. 1. Iron Forms in Place for Pouring Concrete in the Central Wall of the Gatun Locks

FIG. 2. COLLAPSIBLE FORMS FOR 18-FOOT CULVERT

concrete used at this point can hardly be appreciated. Here is the flight of three locks which will raise the vessels from sea level at the Atlantic side to Gatun lake, 85 feet above sea level, the lift being divided equally among the three locks.

The forms used for the side and center walls of these locks are shown in Fig. 1, being set in place for pouring a section of the center wall. These forms are moved along on a track to the desired position, the ends being closed by the sectional pieces shown. The forms are self-contained and the angle pieces on the back are simply carried on the brackets shown so as to be always ready for use when needed. They are used to form the steps on the inside of the center wall and the back side of the outer walls.

The culvert for the flow of water in filling the locks, is shown at the bottom of the center wall with a form in place. This is shown more in detail in Fig. 2 and Fig. 3 shows two forms collapsed and waiting to be moved to a new location.

These culverts are the diameter of a railroad tunnel such as used by the Pennsylvania railroad under the Hudson river.

Roughly speaking these locks are concrete troughs over a mile long (6200 feet to be exact), the center wall being 60 feet thick and averaging 75 feet in hight. Each side of this is a lock 110 feet wide in the clear and an outer wall of the same hight and length. In all three walls is a tunnel for water, by which the locks will be filled, and these tunnels are 22 feet in diameter, the size of the Pennsylvania railroad tunnels under North river. These are also made by forms which can be collapsed, and which are shown beside a lock wall in one of the veins.

It is useless to attempt to give figures showing the amount of concrete in these locks, as they mean almost nothing when you get up into millions, but we can realize a little about it when we know that they are laying 3000 cubic yards of concrete a day and that the mixing plant is using 2 carloads of cement every working hour.

WHERE PRECEDENT WAS DETRIMENTAL

Engineers on the canal work speak in high terms of much of the French work, especially of their locomotives and machine-tool equipment. Some of their dredging machinery is still at work and a new dredge, much larger than the old, is being built by Renfrew, of Glasgow, the builder of those used by the French and the only bidder that could be considered. These are known as the ladder dredge, a sort of bucket excavator, which goes after the rock breaker or drilling barge and

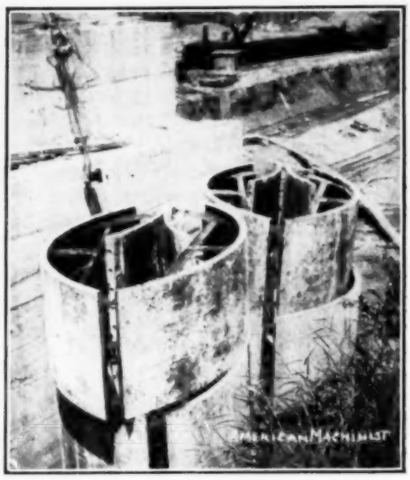


FIG. 3. CULVERT FORMS COLLAPSED AND OUT OF THE WAY

gathers up the mud and rock shattered by the ram or the explosive. One of these ladder dredges is shown at work in Fig. 4 at Mindi on the Atlantic side of the canal.

The rock breaker is simply a barge with a steel ram 50 feet long and weighing 19

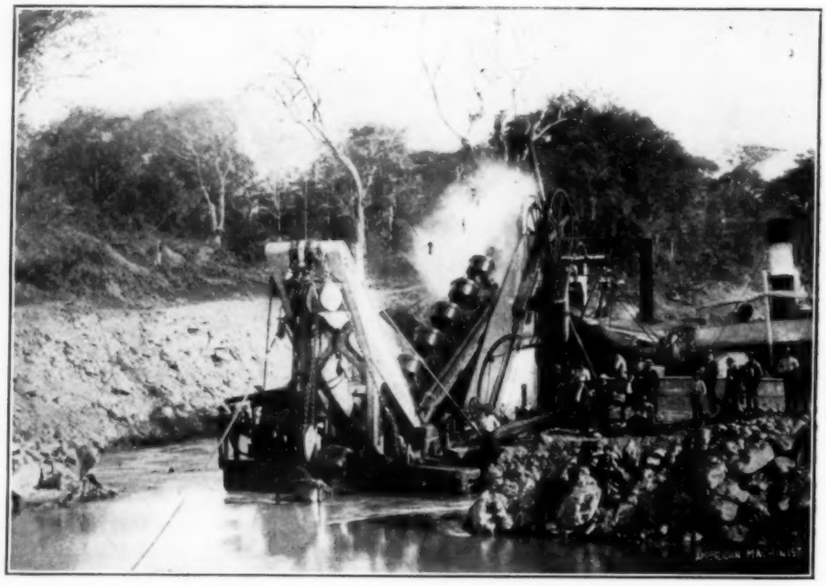


FIG. 4. A FRENCH LADDER DREDGE WHICH IS STILL DOING BUSINESS

tons which is raised by a winch and crushes the rock by dropping on it, from any hight found necessary. The drill barge is used for harder rock and carries a series of deep-well drills which

FIG. 5. ABANDONED FRENCH DREDGES AND STEAM SHOVEL STARTING A NEW CUT

make way for charges of dynamite. Then the ladder dredge moves over the surface and grubs the bottom clean. The load it gathers is discharged into barges and dumped far out at sea. One of the old French ladder dredges is in charge of a Frenchman who has been on the work for over 25 years. These machines are used for the under-water work at both ends of the canal.

When it came to the land excavating, however, the experience at Suez seems to have been a distinct handicap, for Panama presented a problem that was

FIG. 6. FRENCH STEAM ROCK DRILLS AND LOCOMOTIVES

entirely different. The same sort of ladder dredge was tried on land except that it worked from the side, and while it worked fairly well on soft earth, it was almost pitifully inadequate in most places and a good share of the junk which has been bought by the Chicago wrecking firm consists of these dredges which have been abandoned for several years.

The cars too, were small dumps which could neither carry the loads nor stand the punishment of the rocks and dynamite which is sometimes necessary when a rock sticks in the car door. If the French engineers could have forgotten Suez completely, it is quite likely that they would devised better methods and accomplished more in the same time.

A little of the old machinery which was abandoned on account of being unsuitable, is shown in Figs. 5 to 7 and needs little explanation. They are scattered all along the canal, often at quite a distance from the present line of railroad, and one cannot but admire either the capacity for appraisal or the nerve of those who have bought it.

SHOVELS THAT HOLD 6 TO 8 TONS

Statistics are apt to be tiresome and yet it is difficult to even try to give an idea of the work being done without dragging in a few figures and comparisons. There are several kinds of steam shovels at work, from the trenching shovel with its dipper holding ¾ of a cubic yard up to the new shovels with five-yard dippers and which weigh 105 tons each. All told there are 100 steam shovels to be kept at work, and a glance at some of the breakages and failures will show why it keeps a good-sized force busy at the Empire shops, keeping the shovels at work.

If we stop to consider that a cubic yard of "spoil," as it is called, weighs 3900 pounds in rock and 3000 pounds in earth, with an average of 3600 pounds of "the run of the cut," we begin to see what the shovels are up against, especially if we realize that a cubic yard is about a load for two horses. So when one of the five-yard dippers fills up on average work, it holds about eight tons of spoil and four of them fill the largest cars used, for everything is hauled by locomotives and on the best of flat or dump cars, according to the material.

Some idea of the work of a large shovel can be had in Fig. 8. And while every "bite" does not result in such a large rock being balanced on the fingers, it happens more often than might be imagined. Comparing the rock with the men shows its size better than figures can do. Fig. 9 shows what happens to them occasionally and is one reason why such shops as that at Empire have to be maintained.

CARRYING IT AWAY

The average train load is 20 cars, carrying 610 tons, while the larger cars run up to 737 tons and the small dumps down to 562 tons per train. Trains vary from 20 to 35 cars each. These are hauled by locomotives weighing from 106 to 117 tons, there being 158 engaged in this service, while as many as possible of the old French engines, weighing from 20 to 30 tons, are kept in use on light work. But they cannot handle the trains fast enough to get them out of the way in the cuts, and time is one of the important elements.

HOW THE WORK IS DONE

The rock drills go over the ground first, drilling into the rock so that it can be broken up with dynamite and be gathered up by the steam shovels, which follow. In some places the regular well drill has been found best, while in others 295 tripod drills are pounding away to make room for the explosives. And the blasts go off so frequently that you soon cease to notice either the noise or the vibrations of the earth. These undoubtedly help along the "slides" of earth into the cut, and the sides should be more stable after they are all over.

Then come the shovels with their manganese-steel buckets and fingers, eating

FIG. 8. STEAM SHOVEL HANDLING ROCK IN CULEBRA CUT

into the mixture of earth and shattered rock at from five to eight tons at each bite, swinging it onto the waiting flat or dump cars as the case may be, and the train goes swiftly to the chosen dumping ground over the tracks which are being changed every day to meet new demands.

Much of the old Panama railroad is now used exclusively for dirt trains, while the passenger trains use the relocated roadbed. Or, if it comes to a question of right of way on tracks used by both, the dirt train always has precedence.

A FEW MORE FIGURES

Just to show what a day's work can mean, I quote from the records of the canal for March 22, 1910, when one shovel handled 8395 tons of rock. During the same month on the Central division, 51 steam shovels and two cranes with orange-peel buckets took out 127,742 tons of earth and rock. With the smaller cars used at that time, 333 loaded trains were run to the dumping grounds and as many empties brought back. The despatching and signaling of these trains is quite a problem in railroading. But the days of record breaking are over, because of more work being required per ton of material and the longer haul to dispose of the spoil. Still the work is going on with as much energy as ever and those who wait another year before seeing it, will never realize all the work that has been done. The tropical vegetation will cover much of the sides, which are now bare, the waters of Gatun lake will cover much more and every man from Missouri and elsewhere will cynically want to be shown where all the money went.

A DAY'S WORK IN THE TROPICS

One of the notable achievements of the management is the securing of a full day's work in the tropics—in spite of heat and rains—the full day being from 7 to 11 and from 1 to 5 for mechanics. Trains run so that promptness is necessary unless one lives in the same town as the shops, but the commuting habit is so fixed that many live in one town and work in another. House vacancies also have something to do with this. Incidentally this made it necessary for me to leave Panama every morning at 6:30 and arrive there at 6:45 at night—a long day for such a tropical country.

Those who have not studied the map of the Isthmus closely will appreciate the twisted feeling that comes over one at 5 a.m., when he sees the sun insist on rising over the Pacific ocean, which by all general ideas of geography, should be the west. Later in the day we get straightened out because it also sets in the Pacific, where it belongs.

FIG. 7. A GROUP OF ABANDONED FRENCH LOCOMOTIVES AND CRANES

The men on outside work pay no attention to showers, as they are wet through anyhow in five minutes after they start to work. Not from excessive heat, but the humidity brings out the sweat at the least exertion, so that rain does not count. Inspectors and foremen carry umbrellas, in fact the average man or woman on the Isthmus is never without one.

THE RAINS AND THE MEN WHO DIG

And such rains! The rainy season lasts about nine months, during which time it rains four or five times a day on the Atlantic side, decreasing as you go toward the city of Panama; and it rains solid water much of the time. The rainfall on the Colon side is over double that at Panama, while the tides are reversed, being about 20 *inches* at Colon and 20 *feet* at Panama.

It is said that there are 29 different races employed on the Canal Zone and you would not dispute it if the figures were twice as high, for such a motley collection was never seen before, West Indians from Barbadoes, Bahamas, Jamaica and other islands, Spaniards and Italians from Europe and, most noticeable of all, the turbaned Hindu from the far east, who are said to make exceptionally reliable watchmen and to be very useful in positions of this kind. A Kipling might easily wax poetic over the fitness of having the world's great water way dug by men of all the nations of earth.

FEEDING THE MULTITUDE

This would hardly give an adequate idea of the problems that confronted the Canal Commission, without a mention of the way in which the men and families are fed, clothed and secure other necessities such as high-heeled shoes and safety razors. There are 22 general stores in as many villages and camps along the line, with a total population of 65,000 people.

At Cristobal, on the Atlantic side, is a 300-ton ice plant, a cold-storage warehouse, a huge bakery, a coffee roasting establishment, a laundry and last but not least, an ice-cream making establishment.

At 4 o'clock every morning a supply train of 21 cars leaves Cristobal with 11 refrigerator cars for meats and other perishable articles, the other ten cars carrying general supplies. This train replenishes the stocks at all points and gives a good food supply the whole length of the zone.

FIG. 9. STEAM SHOVEL BURIED IN ROCK—A REASON FOR REPAIRS

Especial attention is paid to the drinking water and to sanitation in general, a large squad being constantly employed in cutting rank growth near the towns, in draining the hollows where water might breed mosquitos and in spraying all drains with a mixture which effectually keeps down the busy little "varmints." This is so effectual that I did not see a single mosquito on the Canal Zone, though there are plenty in some other parts of the Isthmus.

AN EXAMPLE OF WATER SUPPLY

As an example of water supply I may mention the 3,000,000 gallon filtration and pumping plant for the town of Gatun, near the great locks, with its dam nearly 600 feet long and 50 feet high. There are sediment basins, gravity filters and three-stage electric centrifugal pumps working against a 300-foot head. This will supply not only the town but vessels going through the locks and is simply one of the incidental pieces of engineering which are dwarfed by the larger work going on beside them. All structures are reinforced concrete.

I have devoted more space than I intended, to a general talk on the canal, but it all has a bearing on the work of the mechanic who must keep the equipment up and perhaps give an idea of the conditions under which he works. The shops are well ventilated, fairly well lighted and a breeze is nearly always to be felt as one walks through them. As in all tropical countries, the side walls are solid for about seven or eight feet, then there is an open space for perhaps six feet, which supplies both light and air.

They are temporary in all cases, as the new and permanent shops will not be located at any of the points now occupied —except perhaps, the small marine repair shop at Cristobal. The large dry dock is to be at Balboa, on the Pacific side.

It is impossible to speak too highly of the thoughtful attention given by everyone on the Canal Zone, from Colonel Goethals down. Only the coöperation and courteous assistance of all with whom I came in contact, made possible the securing of the illustrations and interesting data which will be used in the succeeding articles. These will show the work done at the different shops—the methods used and the conditions under which the entire equipment is kept at the highest efficiency.

A Plea for the Unskilled Workman

BY F. P. STRACHAN

The training of the boys has of late received a great deal of attention, various schemes of apprenticeship have appeared in almost every mechanical journal, but very little is to be found for the unskilled worker. Probably we are becoming too scientific to give him or his condition a thought, and I will suggest a universal dose of Godfreyistic humanity.

The only really unskilled man is in the street. We take him in, and, if he does not show some aptitude or skill for the job we give him, we very soon fire him out again. Some of the ones we keep become quite scientific in keeping everything in order and we become quite proud of the things we can do with unskilled men.

There are quite a number of machines now made which do not require a highly skilled operator, but to advertise the machine and make the assertion "that unskilled labor only is necessary," does not seem hardly fair to the operator on the machine, when we could not even keep the shop floor clean with unskilled labor with a different face every day, and no one would suggest the same process to operate the most simple of machines.

Many machine-tool makers supply an expert operator to start up the machine; these experts are quite willing to take in hand and instruct an unskilled man to operate, an arrangement that is very satisfactory for the foreman and one that should always be taken advantage of.

The expert, if he finds a willing learner, does not spare himself, and the learner is probably looking up to him as the greatest man alive, and goes home at night thoroughly tired out; but as he considers it the chance of his life, he turns up the next morning, fully determined to do better, and in due course he is able to go ahead himself. To consider him still unskilled is a reflection on both teacher and pupil.

I suppose most of us who have the handling of unskilled men, and from time to time promote them, do so (although we are not anxious to admit it) because they show skill, and, in some cases, special skill for the job they are doing meantime, however humble. We all want the best possible from every workman, and personally I cannot see any disadvantage to any shop by calling a spade a spade and a man who operates a machine a machine man or operator, and dropping as much as possible, the term unskilled.

The United States production of platinum in 1909 is estimated by the U. S. Geological Survey to have amounted to 672 Troy ounces, all being obtained from the gold placers of California and Oregon.

Santa Fé Machinery and Tool Costs

By E. J. McKernan*

The standard tools made by the Santa Fé at Topeka for all shops along the line, the shop in which they are made and the tool-storage methods used at other points.

The expenditure for machinery and tools averages about 3 per cent. of the total cost of maintenance of equipment. While a comparatively small portion of mechanical-department expense, the item is a very important one, as shop tools, machinery and facilities bear directly upon efficiency and cost of output of car and locomotive repairs. Good tools to a shop force are analogous to good ammunition to an army.

The importance of good tools is everywhere realized, yet the tool policy on different railroads varies greatly. There is liberality in tool expenditure on one road contrasted with penuriousness on another; indifferent supervision contrasts strongly with effective supervision. The latter dictates expenditure when necessary, eliminates wastes and provides adequate tools and machinery with the end in view of obtaining minimum repair costs and maximum shop output.

*Tool supervisor, Topeka shops.

The General Policy

As an important and necessary feature of betterment work a progressive tool

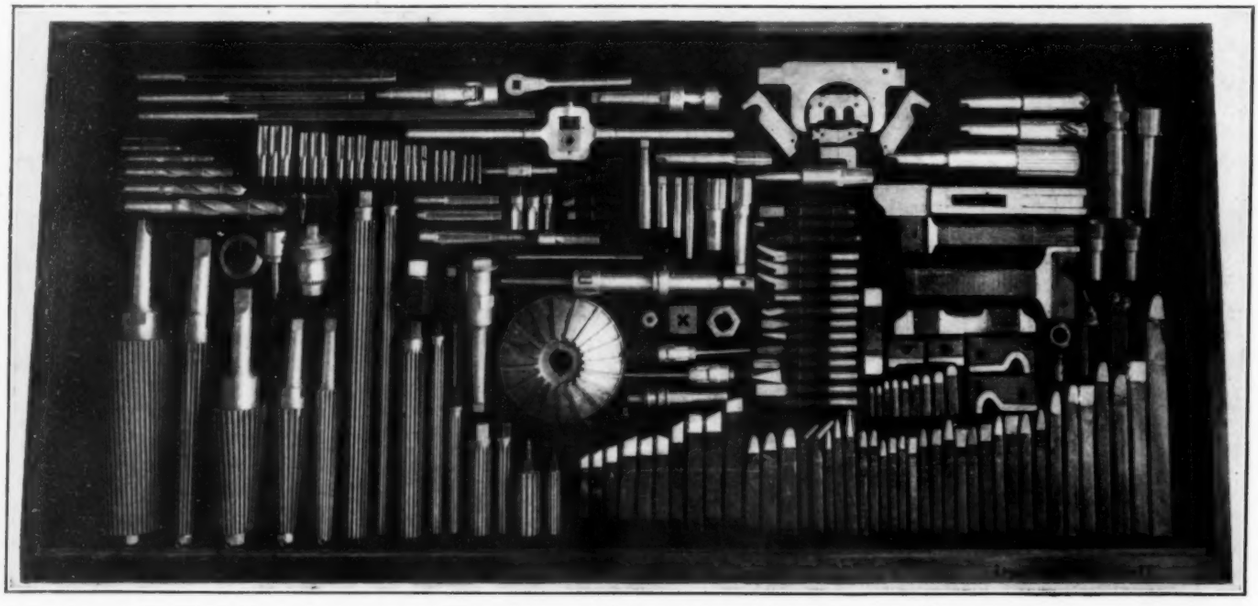


Fig. 1. Some of the Standard Tools, Gages and Devices Kept in Stock

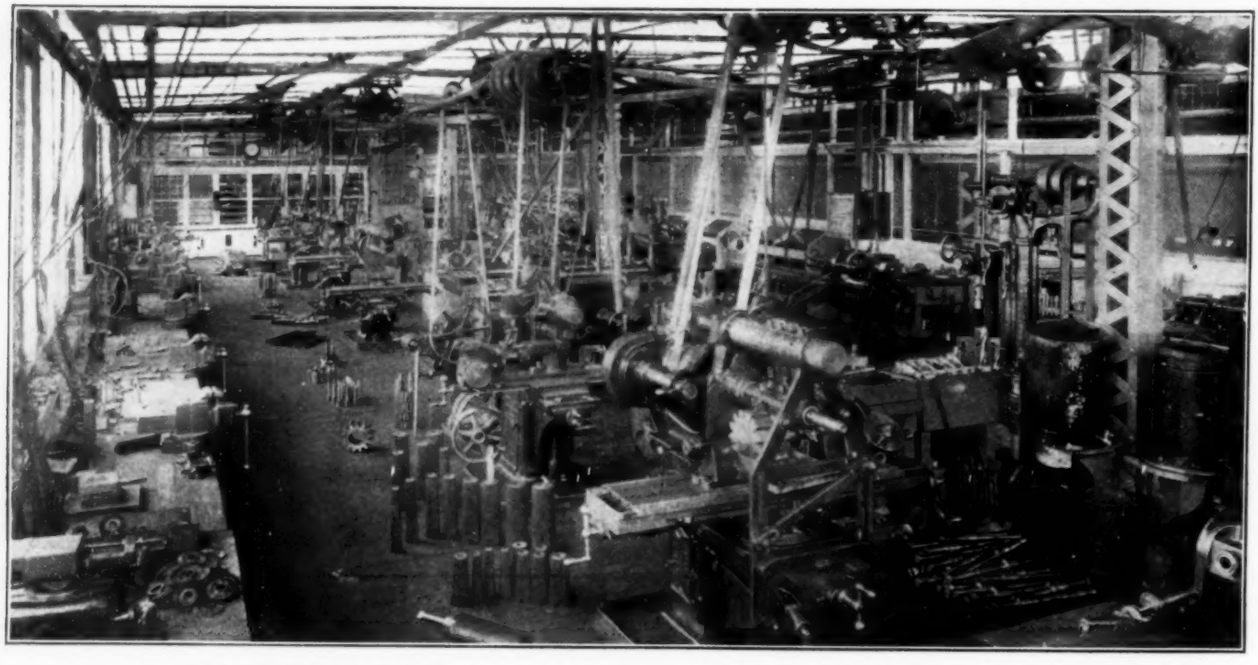


Fig. 2. Tool Room Where the Manufacture of Small Tools Is Concentrated

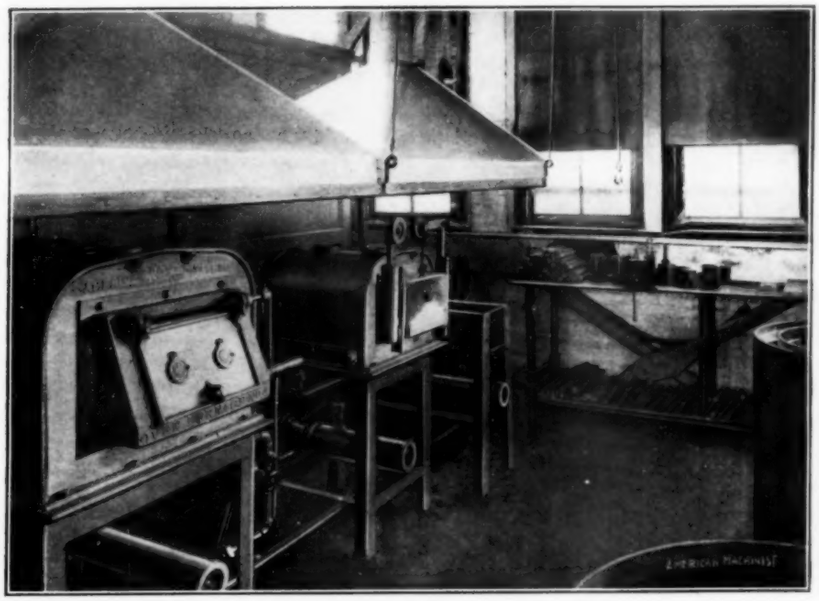


FIG. 3. A CORNER IN THE TOOL-HARDENING ROOM AT THE TOPEKA SHOP

policy was adopted by the Sante Fé in 1904. The aims of this policy were manifold, as follows: To furnish tools and machinery particularly adapted to rapid and economical production; the betterment of machines for obtaining output from high-speed steel and improvement of motors, belting, shafting, etc.; development of special tools, jigs, devices and facilities which would lighten the work of workmen and increase their output capacity; introduction of the most efficient shop facilities for handling material; improved supervision over tools, machines and shop methods for the purpose of eliminating tool wastes, preventing excessive expenditures, selecting the most desirable tools and machinery, developing better shop methods.

In the last six years the new tool policy has been thoroughly tested and the period of time has been sufficient to demonstrate the soundness of the principles involved. That the supervision over shop machinery and tools has been effective is shown in the annual reports, particularly as since the inauguration of the plan, the gross ton-miles handled on the system has increased 54 per cent.

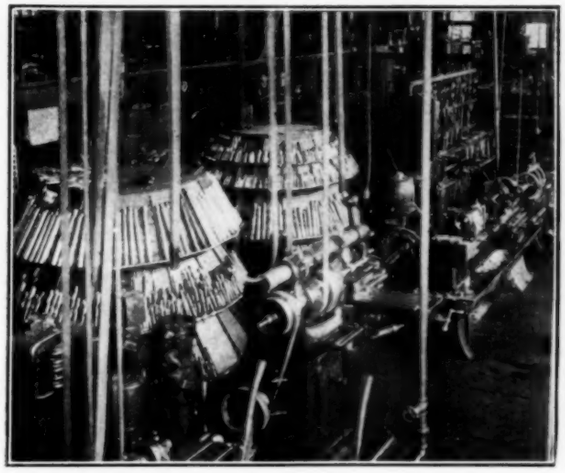


FIG. 5. TOOL ROOM AT ALBUQUERQUE

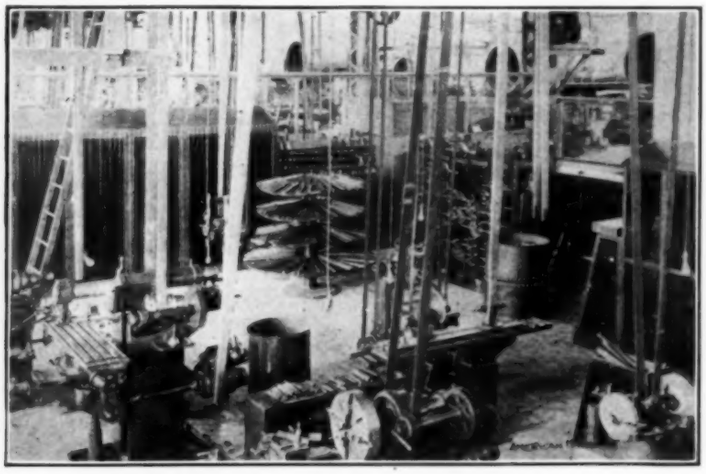


FIG. 6. CORNER OF THE TOOL ROOM AT SAN BERNARDINO, CAL.

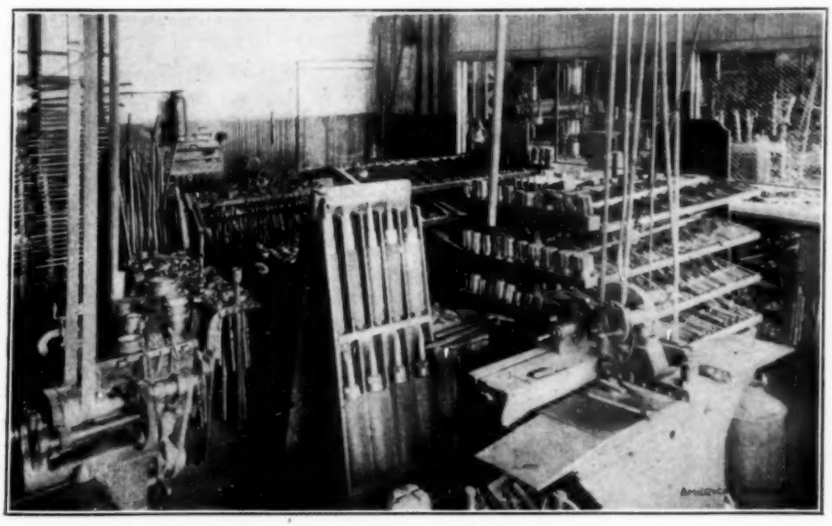


FIG. 4. PART OF THE TOOL ROOM AT LA JUNTA, COLO.

The total tool expense (capital charges plus operating expense) has been decreased steadily since 1904.

NEW EQUIPMENT

Naturally the conditions surrounding tools and machinery in the shops must be considered before accepting without question the large reduction in cost. Have proper and sufficient tools been furnished, or additions, betterments and maintenance curtailed to the detriment of the service? If cost reduction has been obtained at the expense of shop output and cost of production, obviously the money saved in tools is swallowed up many times over in increased expense of shop operation and delays to output. Ample

additions and betterments have accompanied decreased tool costs, the new equipment being distributed among 34 shops last year.

In addition to this, requirements for small tools, jigs, motors, special tools, etc., were supplied monthly from Topeka, according to the stocks on hand in the various tool rooms, as shown by the tool-stock books. Fig. 1 shows a few of the standard tools kept in stock at Topeka for distribution to outside shops upon requisition.

Local Tool Rooms

Stocks of tools and devices in local tool rooms have been closely supervised to prevent wastes and excess, but never before in the history of the road have shops been so well equipped with an efficient complement of small tools for all work. An inspection of local stocks of tools shows sufficient supply of tools for any shop condition, but without an expensive and wasteful excess and its consequent congestion of tool rooms and higher costs. Figs. 2 to 6 show portions of tool rooms in respective shops of the system and their corresponding stocks of standard tools and devices in convenient racks for distribution to the men. Fig. 2 illustrates the tool room at Topeka, where the manufacture of small tools and devices for all system shops is concentrated, and Fig. 3 a corner of the hardening room in the same shop.

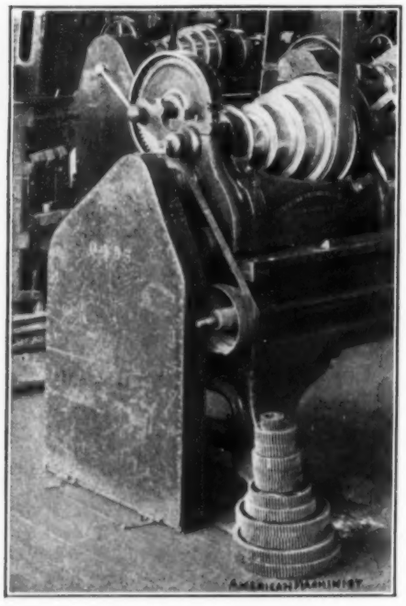


Fig. 7. Protecting Housing for Lathe Gears in Topeka Shops

The safety of the men engaged in shop work has also received more than usual attention, especially at Topeka, where John Purcell, superintendent of shops, has inclosed gear and belts in protective housings. Fig. 7 shows a typical housing for the gears on a lathe: Hinges at the bottom allow the housing to be swung out of the way when changing gears and a catch at the top hold the housing in place. Protection of this kind has been extended to all dangerous mechanisms around the shops.

Under Santa Fé tool methods, additions and betterments are made where the need exists. Expenditure for new equipment must be justified by proof which spells greater economy and output. The outlay involved does not govern when once these facts are determined, which results in a conservative but effective addition to shop equipment from year to year. In this way the increasing demands upon shops for greater output has been met by economical expenditure—a sum so conservative for a large railroad that it might appear inadequate, except when the conditions are known.

Boss Betrayed by Babbitt

You couldn't fool the old man; that is, when he was awake—and he never slept. Every minute of the day he was very much "on the job."

Of course, when a boss shows his men that he has an intense, abiding faith in his own infallibility, the men are always alert to puncture his balloon of assurance—and hearty laughter always accompanies the sound of the escaping gas.

The little shop employed about a dozen men. The stovepipe burned out one day and the boss replaced it with a piece of 6-inch spiral-riveted galvanized pipe, which was to stand for many years, or as the boss put it, "until hell freezes over." On its way to the chimney the pipe passed over the cylinder of the gas engine, which made it rather warm for the solder on the pipe.

One morning, shortly after the new installation, the boss came rushing out of the office bareheaded, probably on his way to tell someone "I told you so," his favorite expression.

As he passed by the engine and under the stovepipe a piece of hot solder dropped on his head!

He *exclaimed*, which is putting it very mildly, and looked about for the cause of his discomfiture. Solder spattered on the floor led to the conclusion that the crank-pin bearing babbitt was hot and melting. The boss yelled for the boy who looked after the oiling, and then threw a bucket of dirty wash water at the crank. Of course, the splash drenched him.

His yells brought every man running. One of the men pointed to the source of the hot metal and a roar of hearty laughter followed.

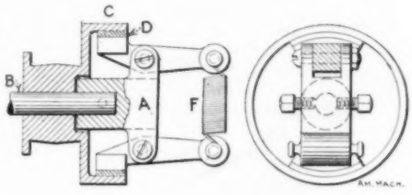
"That was one on me," laughed the boss meekly, as he retired to his office.

A Governor Pulley for a Sparking Dynamo

By W. Alton

When a small dynamo is used to furnish the spark for a variable-speed gasolene motor it is often necessary to arrange the drive so that if the dynamo is running fast enough to furnish the spark when the motor is running slowly it is speeded too high when the motor is at full speed.

Various kinds of governors have been devised to keep the dynamo speed approximately constant. The accompanying cut shows one that I fitted to a small dynamo.



A Governor Pulley

Yoke *A* is setscrewed to armature shaft *B* and carries two governor arms *E*, provided with leather friction surfaces *D*, which bear on the inside rim of the belt pulley *C* at ordinary speeds.

Whenever the speed rises above the normal the outer ends of arms *E* separate and release the clutch surfaces *D* from the belt wheel *C*, which then runs loose on the armature shaft. Of course, this kind of a drive gives a varying speed to the armature, within certain limits, but it is good enough for ignition work.

I had one of these pulleys in use for several seasons and it worked perfectly.

With alloys containing tin the red brasses and bronzes are approached. Ordinary engine brasses are commonly made from an alloy containing 13 pounds copper, 2 pounds tin and 2 pounds zinc. Sometimes a small quantity of lead is added to improve the machining qualities. In making an alloy of this kind it is well to use a little phosphor-copper or phosphor-tin to help clean the metal and cause it to pour properly, so as to form sound castings. It is necessary to use only a relatively small percentage of phosphor-copper or phosphor-tin in the mixture as it is not the intention to leave any free phosphorus in the finished alloy. Phosphor-copper and phosphor-tin can be purchased from any metal dealer or foundry supply-house. For pump parts a bronze that is frequently used is composed of 88 parts copper, 10 parts tin and 2 parts zinc. It will be noticed that this is practically a gun metal to which a little zinc has been added.

Emergency Casting Equipment—I

By Henry M. Lane*

Making simple castings for repairing broken machinery in an out-of-the-way place.

The construction and operation of a small cupola for melting iron for casting.

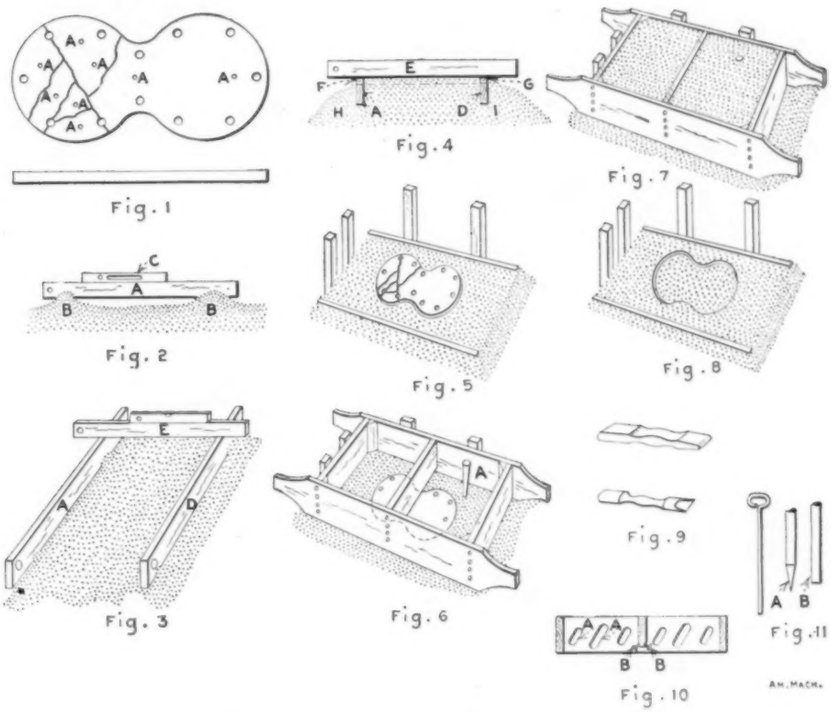
The method of making green-sand molds for such castings as pump-cylinder heads.

*Editor, *Castings*, Caxton building, Cleveland, Ohio.

When a machine breaks in a mining camp or in any other out-of-the-way place, the blacksmith is usually called upon to make temporary repairs, while the superintendent sends a message or letter to the outside world for a casting. The only reason that the average mine superintendent does not make his own castings is that he has not been shown how simple it is. All that is necessary is a mold so constructed that as the metal enters, the air and gas will be expelled, and the mold completely filled with metal. This necessitates some equipment for melting iron, and here the prime requirement is the absence of sulphur in the fuel. Given these fundamentals, good castings can be made.

The foundryman divides molds into three classes, green-sand, dry-sand and loam molds. The method of making these three classes will be discussed later. In melting metal and particularly in remelting scrap, there are certain rules which must be observed to obtain the desired physical properties in the casting, but these are simple and can easily be mastered.

The following are required: A pattern or form to make an impression in the sand that will serve as a mold to receive the molten metal. Sand that will not fuse in the presence of the molten iron and which contains sufficient bond (clay) to enable it to hold its form while the metal is poured into the mold. A box or "flask" for supporting at least the upper part of the mold while the castings are being made. Some scrap iron of suitable composition for producing the required grade of castings. A furnace that will melt iron with sufficient rapidity to insure the desired amount for the casting. Fuel with a low sulphur content which can be used in the melting furnace. This fuel may be coke, anthracite coal or charcoal; the relative advantages of each will be discussed later. A ladle to carry the metal from the furnace to the mold; this ladle must be lined with clay, dried and heated before the metal is poured into it. For hollow work, cores are required, that is, bodies of sand which can be supported on the inside of the mold to form the interior of the casting.



STAGES IN THE MAKING OF GREEN-SAND MOLDS

MAKING GREEN-SAND CASTINGS

Fig. 1 shows a repair I made some years ago. First, it was necessary to produce a level bed of molding sand in which the broken pieces could be bedded, and while the molder was preparing this the broken casting was sent to the machine shop and the holes marked *A A* were drilled in the broken pieces and a ½-inch tap run through each so that a bolt could be screwed in to lift the pieces from the mold. The old bolt holes were not stopped permanently. The method of treating them will be described later.

PREPARATION OF THE SAND BED

While the machinist was busy drilling and tapping the holes, the molder took a straight-edge as shown at *A*, Fig. 2, and supported it on little mounds of sand *B B*. The straight-edge was rapped down until its upper surface was level, as indicated by the ordinary carpenter's level shown at *C*. He next placed another straight-edge parallel to the first, as shown at *D*, Fig. 3, and by means of a straight-edge *E* placed across the two, he was able to tuck sand under the straight-edge *D* and rap it down until the upper surfaces of *A* and *D* were in the same horizontal plane. He then tucked sand under *A* and *D* for the entire length and banked sand between them and against their outside faces, ramming it in place so as to support the straight-edges and prevent their moving.

RAMMING THE SAND

For ramming the sand either hand or floor rammers may be used. The floor rammer is a piece of iron pipe about 4 feet long, to the ends of which are attached suitable rammer heads. Sometimes the heads are of bronze and the staff of wood, in place of being made of iron. As an out-of-the-way place is not usually equipped with the regular tools of the foundry, however, hand rammers can be used for this work, and Fig. 9 shows two types; the upper one is made from a piece of 2x4-inch timber about 18 inches long.

Loose sand is put into the mold to the depth of three or four inches, and this is first rammed with the peen, the successive strokes being made about two inches apart. It is next surfaced down with the butt. The experienced molder is careful not to ram his molds too hard, as the sand should be sufficiently soft so that there will be some opportunity for the gases generated as the mold is poured to escape through the sand. In emergency work, however, this is frequently

disregarded and the mold rammed fairly hard and provision made for the escape of the gases by the liberal use of the vent wire, which will be described later.

As the sand is filled in about the straight-edges *A* and *B*, shown in Fig. 3, it is rammed first with the peen and then with the butt of the rammer. This should be continued until there is a space about three inches deep left between the straight-edges. The space on the outside can be rammed clear to the top. The center should then be filled with sand which has been passed through what is known as a No. 4 riddle or sieve.

The riddled sand is shoveled in between the straight-edges or it is riddled into place. After the sand has been brought up even with the top of the bars it is struck level by dragging the straight-edge *E* along the bars *A* and *B*.

After the surface of sand between *A* and *D* has been struck level, two thickness strips *F* and *G* are placed on top of the straight-edges *A* and *B*, as shown in the cross-section, Fig. 4. For the class of work shown these should be about ¼ inch thick. More sand is then riddled between the thickness strips until it comes just flush with their top. Care should be taken not to introduce much of an excess of sand, as the falling sand tends to pack itself. The sand is then struck level with the top of these strips by means of the straight-edge *E*. After this the strips *F* and *G* are removed and generally a little sand cut away close to the strips *A* and *D*, so as to make the subsequent operation easier.

Venting for the Escape of Gases

For light work and comparatively thin castings like the one under description it is not necessary to make special provision for carrying the vent from the bottom of the bed, provided the sand between the straight-edges *A* and *D* is not rammed too hard. The method of accomplishing this is as follows: Have one man hold one end of the straight-edge *E* stationary while the man on the opposite side lifts his end and brings it down on the sand with a blow sufficiently hard to bring it level with the top of the straight-edges *A* and *D*. After one man has struck three or four blows with his end of the straight-edge he in turn holds his end still while the other man lifts the end which was formerly still and strikes a few blows, advancing his end of the straight-edge as each blow is struck. In this way, beginning at one end, the men pound the sand down level with the top of the straight-edges *A* and *D*.

After the sand bed has been prepared in the manner stated, the broken parts of the casting shown in Fig. 1 are assembled upon the sand bed as shown in Fig. 5. Sand is then tucked or lightly rammed around the edge of the casting so that it will be about as hard as the bed, and this new surface is extended three to five inches back from the casting on all sides and then allowed to taper down to the bed.

Making the Flask

In Fig. 5 four stakes are shown driven into the bed to assist in guiding the flask, and in Fig. 6 the flask is shown in place, being guided by the stakes. At *A*, Fig. 6, is shown the "sprue pin," which is a conical plug, generally made round, though it may be square, but it must have sufficient taper to enable it to be drawn from the sand easily. The lower end of the sprue pin is stuck into the bed to such a depth as to enable it to stand in a vertical position, as shown.

The No. 4 riddle is then taken and about an inch of sand sifted into the flask over the pattern, which in this case was the old cylinder head. Before this is done, however, the small holes in the pattern, that is both the old bolt holes and the holes marked *A*, should all be filled loosely with sand and struck off level with the top of the pattern.

Before any sand is sifted on the pattern some material must be placed over the face of the bed and of the pattern to prevent the sand in the upper part of the mold, which is called by the molder the "cope," from sticking to the sand in the lower part of the mold. This material is called "parting sand." Clean, dry, sharp sand may be used for this purpose, or burnt sand which has been burnt at a high enough temperature to destroy the bond in the clay. Sand cleaned from old castings is frequently sifted and used for this purpose.

After the holes in the casting have been filled and the parting shaken over it, sand is sifted over the surface of the mold as above referred to; this sand is known as "facing sand." All of the sand that is put into the cope should be sifted, but after the first inch or two has been riddled in the rest of it may be shoveled from a heap of riddled or sifted sand. About six or eight inches is shoveled in, when the ramming should begin, first ramming with a peen, care being taken to peen around the outer edge of the flask first and then over the inner surface. After the surface has been well peened more sand is shoveled in and the ramming continued until the cope is full, when the upper surface is finished by ramming with the butt of the rammer and then struck off with the straight-edge.

After the surplus sand has been struck off the sprue pin *A* is withdrawn, leaving an opening which is known as the "sprue" or "gate," as shown in Fig. 7. The cope flask is then carefully lifted off and set to one side on its edge. The parts of the broken casting are then withdrawn from the sand by means of a ½-inch bolt screwed into the holes *A A* drilled in the broken pieces. Before drawing the parts the casting should be rapped back and forth slightly with a hammer so as to force the sand back around the outer edge of the pattern, thus enlarging the mold sufficiently so that the parts may be lifted out without tearing up the edge of the mold.

Shrinkage Allowances

As molten iron shrinks ⅛ inch per foot in cooling, this rapping of the pattern and enlarging the mold will serve to partially overcome the effect of shrinkage. In the case referred to the new casting will probably be a little smaller than the

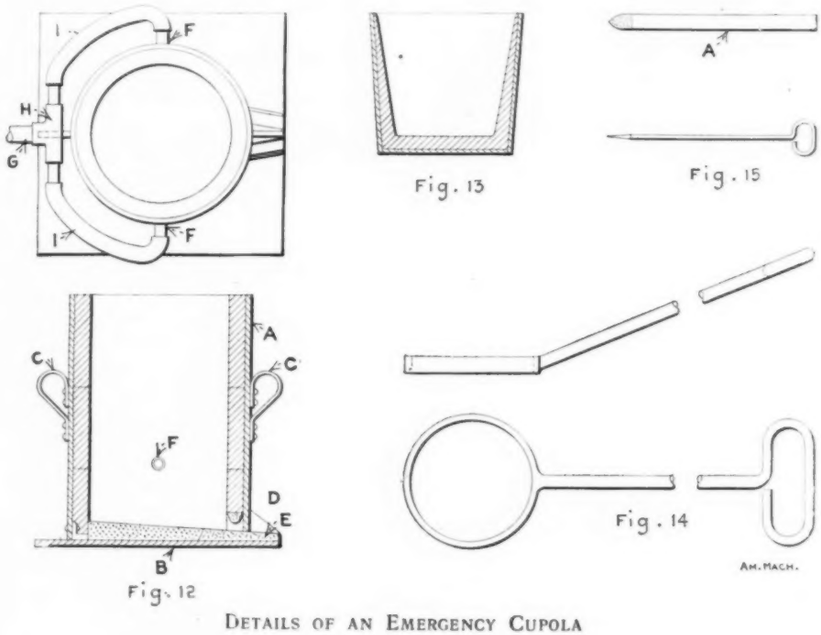


Fig. 12 Fig. 13 Fig. 15 Fig. 14

AM. MACH.

Details of an Emergency Cupola

old, but if sufficient rapping is done it will be practically the same size. Ordinarily, when patterns are made for castings an allowance of ⅛ inch per foot is made to overcome shrinkage.

After the parts of the casting have been rapped so as to loosen them they are lifted out by screwing a bolt into the holes marked *A A*, which will leave the mold as shown in Fig. 8. A shallow opening or gate is cut from the bottom of the hole left by the sprue pin *A*, Fig. 6, to the opening left by the pattern, as shown in Fig. 8. In this case two shallow channels branching out from the sprue pin and joining the mold about three inches apart are shown. This horizontal part of the gate can be cut with a bent piece of tin or small trowel, and should not be over ⅜ inch high where it joins the main casting, so that it can be broken off easily when the casting is removed from the mold.

After the gate is cut the cope flask shown in Fig. 7 is lifted and returned to its position, being guided by the stakes. It is next necessary to weight the cope to overcome any tendency the molten metal may have to float it from the mold. For a casting of this size three or four good-sized chunks of scrap iron can be placed on top of the flask as weights. It is a wise precaution, however, to place two boards across the top of the flask to protect the sand and then lay the weights on them. The mold is then ready to receive the molten metal, which is poured in a steady stream from a ladle through the opening or sprue.

If the sand in the cope is of an open nature and not rammed too hard this mold could be poured without any special venting, but as those engaged in emergency foundry work are not accustomed to the proper degree of hardness in ramming it is best to do some venting, the method of which will be described later.

Venting the Cope for Escape of Gases

It is also well to take some precautions against any chances of the sand dropping out of the cope. As shown in Figs. 6 and 7 the cope is provided with a bar across the center, dividing it into two parts. The object of this is to increase the resistance of the sand against the sides of the flask and to reduce the area that the sand must bridge in the center of the flask. Ordinarily the bars in the flask should be placed not over 10 or 12 inches apart, and for many classes of work it is best to place them 8 or 9 inches apart.

The inside surface of the flask may also be roughened by gouge cuts as shown at *A A*, Fig. 10. hese form pockets or sand anchorages in the sides of the flask. Sometimes nails are driven into the bottom of the bars as shown at *B B*, Fig. 10, but this is not considered good practice, as it is necessary to tuck the sand under the bars by hand with the ends of the fingers during ramming, and if nails are used they scratch and injure the ends of the fingers. It is generally better practice to taper the lower edge of the bar and to roughen it with gouge cuts.

To provide for the escape of gases in the upper part of the mold the sand over the pattern may be pierced with a long, straight wire known as a "vent wire." At the left in Fig. 11 such a wire is shown. This should be made of any straight bar from ⅛ to $\frac{3}{16}$ inch in diameter for use with copes from 10 inches to 12 inches in depth. For shallower work a smaller wire is frequently used. This wire is thrust down to within an inch of the surface of the pattern so as to make holes one or two inches apart all over the upper surface of the mold. Sometimes a straight wire is used and thrust clear through the cope after it is lifted from the flask, the wire being entered on the cope side, that is, the side which was next the casting or pattern and withdrawn from the top side. In this case

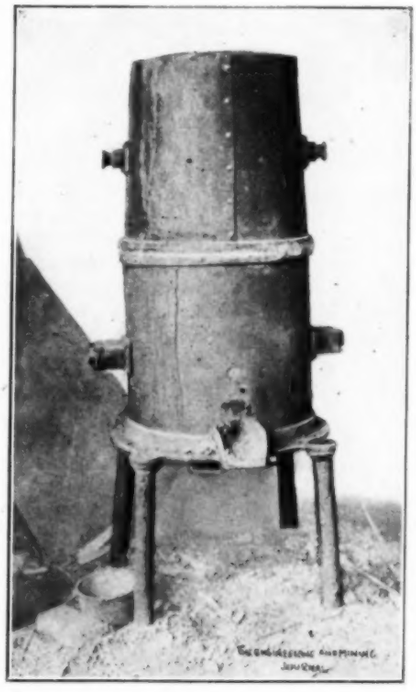


Fig. 16. A Portable Cupola with Drop Bottom

the metal will flow up into these vents when the mold is full, but these small projections can easily be broken off. Generally the vent wire is thrust down from the upper surface of the cope and is not allowed to touch the face of the pattern, the gases being expected to find their way through the sand for from a half to one inch and collect in the ends of the vent passages from which they escape.

Shape of Vent Wires

There has been much controversy among foundrymen as to the best shape for the point of a vent wire. Some insist upon using a sharp point, as shown in detail at *A*, Fig. 11. When this form of wire is used the sand is crowded to one side and the wire hugs the sand through its entire length, which makes the forcing of the wire through the sand difficult. It is generally considered to be better practice to cut the wire at right angles, as shown at *B*, and some men even slightly upset the end of the rod by pounding it with a hammer. A vent wire of this kind can be forced through the sand more freely than a pointed one, as it makes a hole larger than the wire and avoids friction on the sides of the rod.

The gases generated in the mold contain hydrogen, and are therefore combustible. Most molders ignite them at the surface of the mold by passing a piece of red-hot iron or some burning shavings over the top of the vent openings.

After the metal is poured into the mold it should be left sufficiently long to become solid. If the casting is not wanted immediately it is better not to shake out the mold for from half an hour to an hour, for castings 1 inch to 1½ inches in thickness, and in the case of large or intricate castings it is best to leave them in the sand to cool. The cope may be lifted off and the sand shaken out of it over the casting within a few minutes of the time the mold is poured, though for heavy work (two inches or more in thickness) it will be best to leave the cope in place for an hour.

A Cupola for Emergency Work

The cupola furnace, which is the type in which the metal is in contact with the fuel, will be described. The fuel used in these furnaces must be high in carbon, low in ash, and free from sulphur. Anthracite coal answers the purpose very well. Coke, if it does not contain over 1 per cent. sulphur, will do admirable melting, and where neither of these can be obtained, charcoal may be used. A cupola of the simplest form for emergency work is shown in Fig. 12. It consists of a steel shell *A*, about 30 inches diameter and 36 to 40 inches high. This shell rests on a plate *B* which may be made of any convenient material. I have seen brick, stone, steel plates and cast-iron plates used for this purpose.

In the cupola shown, an angle iron has been riveted around the inside of the shell to support the brick lining. The shell is also provided with two handles *C C* which are used in lifting it about during lining or in removing it from the bottom after the run is completed. To prepare for a run the shell is lined

with firebrick if they are available, and, if not, with a mixture of clay and sand. Fireclay is preferable for this purpose, but I have seen common clay used.

After the shell is lined it is dried by a wood fire and any cracks are then repaired with clay mixed to the consistency of mortar, after which the lining is again dried. At the front of the shell there is an opening *D* through which the metal is tapped. This consists of a notch in the shell about four inches square. A corresponding opening is left in the brick work. After the shell has been lined it is lowered on the bottom plate as shown and a sand bottom rammed in. The bottom in the cupola proper can be made of ordinary green molding-sand tamped in about as hard as it would be for a green-sand mold.

At the front of the furnace, which is known as the breast, a tapping spout is made, as shown at *E*. The tapping spout can be made of fireclay and sand mixed together, tamped in and dried by building a small wood fire upon it, using shavings and small chips. The breast or spout material is allowed to project into the interior of the hearth a little so as to prevent cutting of the bed or bottom just inside the tapping hole. In forming the tapping hole a stick about ¾ in. diameter is laid on the spout and the clay and sand mixture tamped about it. Some foundrymen do not put in the breast and make the tapping hole until after the fire has been started, but as a general rule in the case of emergency cupolas it is best to make it up first. If the bed material is made of molding sand not too damp it will dry out sufficiently during the firing up of the furnace and will give no trouble. Sometimes it is best to make the bed of fairly dry sharp sand, and then sprinkle the surface with clay wash.

There are two round openings in the sides of the shell as shown at *F F* and to these openings are attached short pieces of pipe to serve as tuyeres. In the illustration the blast is brought through the pipe *G* to the elbow *H*, from which it is conducted to the tuyeres *F F*, through the two pieces of hose *I I*. This hose may be made of rubber or canvas.

A canvas hose is generally preferred and can be tied to the ends of the tuyere pipes *F F*, and if anything should go wrong so that is desired to open one of the tuyeres the canvas can be slipped from the tuyure pipe, giving immediate access to the interior of the furnace through the tuyere. The hole through the lining should be tapered so that the tuyere has a larger area on the inside than next to the shell. With a small cupola of this type a blast pressure of three or four ounces will be sufficient.

As the hight of the shaft increases the pressure should be increased until at elevations less than 2000 feet above the sea level a pressure of 10 or 12 ounces would be required for cupolas in which the distance between the tuyeres and the charging floor is 12 feet or more. Some advocate a higher blast pressure, but if the tuyere area is ample it is not necessary. For elevations of over 2000 feet higher pressures are required. The blast may be furnished by any convenient means. If an air compressor is in use at the plant a connection may be made to the pipe *G* and a small quantity of air introduced into the pipe *G* from the regular air line, the pressure being reduced from the 60 or 70 pounds existing in the air line to the few ounces required, by throttling the flow at the valve. If the place is not equipped with an air compressor the blast may be supplied by the blacksmith's bellows or blacksmith's fan. The tuyeres should be six or eight inches above the bottom of the furnace for ordinary work, as this allows the accumulation of 100 pounds or more of metal in the furnace.

The spout should be so formed that the metal in flowing from it will not come in contact with the edge of the plate *B* or it will melt the plate. The plate *B* should be supported on masonry or any other convenient support which will hold it high enough above the floor to permit a ladle to be set under the spout.

Blowing In the Cupola

In starting a heat a wood fire is built in the furnace, the hose pipes *I I* being removed from the tuyeres *F F*, the tapping hole *D* being left open. As soon as the wood is well kindled the fuel to be used is introduced and allowed to burn through until it appears red on top. The bed of incandescent fuel should extend at least a foot above the top of the tuyeres and it is better to have it extend 14 to 18 inches above before any metal is introduced. The greater the blast pressure the higher must be the bed.

After the bed is heated through, some of the metal to be melted is placed on it and then covered with another layer of fuel, after which another layer of metal is added and so on until the furnace is full.

The layers of fuel between the charges should not be over four inches in thickness. Each charge of fuel added can be depended upon to melt eight times its weight of metal in a furnace of this kind, and by weighing an amount of fuel equal to a layer four inches thick in the cupola and then multiplying this by 8, the weight of the metal charges can be obtained. Some advocate placing more metal on the bed than on the succeeding charges, but this is not good practice. In large cupolas it is proper to multiply by 10, and a thicker layer of fuel may be used.

The fuel in the bed performs two functions; it acts as a staging or scaffolding to support the metal to be melted, and that part of it above the tuyeres is burned by air introduced at the tuyeres thus producing the heat to do the melting.

Usually the tap hole *D* is left open after the metal is charged until the first 50 or 60 pounds of iron flow out, then the tap hole is stopped. This is necessary to warm the bottom. After the metal has been charged, together with succeeding layers of fuel, the furnace should be left for half an hour or more to allow the metal on the bed to become heated through and the fuel on the succeeding layers to become ignited. The tuyeres may then be connected to the blast pipe by means of the hose, and the air blast be turned on. The hottest point will be at what is known as the melting zone. This varies from 12 to 20 inches above the tuyeres. In a small cupola of this type using a blast of only 3 or 4 ounces the melting zone is sometimes only 8 or 10 inches above the tuyeres, but usually it will be at least a foot. The lining will have a tendency to burn out more rapidly at the melting zone and an examination of the lining after one or two heats will give a close idea as to the location of the melting zone.

Sometimes a short cupola like that shown in Fig. 12 does not have sufficient draft to cause the fire to start rapidly and in such a case may be necessary to let a small amount of blast in through the tuyeres from the time the coke is well ignited and to begin to blow the charge with the full blast as soon as all the iron is in. In such a case it is necessary to have the top of the bed one or two inches higher when the iron is charged than would be the case where natural draft is depended upon. By judicious use of the blast in starting the fire the time from lighting the fire until the first iron is melted can be greatly reduced.

Operating the Cupola

When the iron begins to flow from the spout it is allowed to run on to the floor until from 40 to 60 pounds have passed out, after which the spout should be stopped with a "bot" made from a mixture of sand and clay formed into a ball as dry as it can be worked. This is placed on the end of what is known as a bot stick. For emergency work the bot stick is generally made of wood as shown in Fig. 15. The bot of sand and clay on the end should be formed into a point as shown. In introducing this into the stream the point of the bot should be brought just above the stream close to the tapping hole and it should then be carried down and forward by a quick movement which will ram the sand into and through the tapping hole, thus effectually stopping it and filling the hole with sand.

After the cupola has been stopped the blast should be continued for a few minutes and then the stopping cut away with a tapping bar like that shown at *B*, Fig. 15. The end of the bar is drawn

down to a square point. Some prefer to use a chisel-shaped point, but either is satisfactory. The sand should be picked away from the hole carefully until it is practically all removed when the tapping rod should be run through the hole and drawn out quickly. The metal will immediately flow and can be caught in the ladle. As soon as the metal ceases to flow the tapping hole should be stopped once more. The stream of metal can be cut off at any time by stopping the tapping hole with a bot.

In a cupola of this size there should be no difficulty in melting the metal at a high enough temperature so that it can be held in a large ladle until 200 or 300 pounds have been tapped out, and, in fact, in a cupola of 20 inches diameter on the inside and 40 inches high, I have seen 400 pounds of metal melted and tapped into two ladles and a 350-pound casting made from them.

As the melting continues and each charge is completely melted the fuel above it comes down to replenish the bed and allows the next succeeding charge to gradually settle into the melting zone. As the charges settle additional material may be charged, keeping the cupola full at all times. To hold the heat down some prefer to put a shovelful of damp coke dust or charcoal dust on top of the cupola when it has been charged full. A cupola of this size can be kept in blast for an hour or more and in that case 1000 pounds or more of metal can be passed through it.

Blowing Out the Cupola

After all of the metal has been melted a pair of bars can be stuck through the handles *C C* and the whole shell lining and all be lifted from the bottom and set to one side to cool. The unburned portion of the coke and any slag or dirt which may remain in the cupola are raked off. Sometimes a cupola of this kind is made in two or more sections placed one above the other and after the heat they are removed in succession.

A small portable cupola used as an auxiliary in a gray-iron foundry is shown in the accompanying halftone. One of this style would be suitable for use in a mining camp. In this case the bottom is provided with a drop door hung on a hinge at the back and arranged with a latch at the front. Before beginning the heat the bottom door is latched into place and the bed made up with sand. After the heat is completed the latch is knocked to one side, the bottom door allowed to fall, and this in turn allows any coke, slag or unmelted iron remaining in the cupola to fall to the floor. This cupola is also provided with a cast-iron spout lined with clay and arranged as shown in the illustration. The shell of the cupola is in two sections, the upper one being arranged to lift off for relining, cleaning or to enable the melter to make up the bottom of the cupola.

If much melting is to be done, of course it is well to buy a small portable cupola such is is furnished by the regular foundry-supply houses, but for emergency work any kind of a shell that is capable of supporting a lining may be used. I have been told of cases in which old gasolene or kerosene drums have been used for this purpose, and have known of one case in which a wooden barrel was used, the barrel being used simply to form a clay pot. The barrel was then burned away while drying the clay and the whole arrangement strengthened by placing some sheet tin over the outside and winding wire about it. This certainly is the crudest kind of a furnace, but it was said that it was successful in melting several hundred pounds of metal.

Fluxes and Fuels

Small emergency cupolas such as are herein described require no fluxing. Larger cupolas, however, should be fluxed with limestone or fluorspar. If the metal is to be held in the ladle for some time it should be covered with fine charcoal (lumps up to the size of a hickory nut). The fuel for use in a small cupola of the size described should be broken so that the pieces average about as large as a goose egg. For larger cupolas it is not necessary to break the coke or charcoal.

In small cupolas it is usually better to use coke than any other fuel, on account of the fact that all of the bed below the tuyeres takes no part in the melting, but simply acts as a staging for supporting the metal above, and where anthracite coal is used the discarding of this bed at the end of the heat is the cause of considerable waste. Charcoal is so much more bulky than coke for a given heating value that it is difficult to get enough stock into a small cupola to carry on a successful melting, and, in fact, it is generally necessary to make an emergency cupola considerably higher when employing charcoal.

Burning Charcoal

Charcoal is the best when purity is considered, as it is freer from sulphur and also from ash than any other fuel. A supply of charcoal can be made in any place where wood is available by cutting the wood into pieces about three feet in length, piling it in a close pile of from one to three cords, and then covering it with sod and clay, leaving one or more small openings at the top and two or three near the bottom. Fire is then started at the openings near the bottom and allowed to burn until the mass inside the pile is well ignited. The draft at the lower openings is then gradually checked and the upper openings partially closed until the mass is thoroughly charred. The openings at the top are finally closed and lastly those at the bottom.

If the covering is tight the charcoal may be left to cool in the kiln and will do so without burning; but should the covering leak, enough air may enter to burn a considerable portion of the coal, so that some prefer to rake the heap open when it is thoroughly buruned and extinguish it by throwing water over it. This has one marked disadvantage, and that is that it introduces a large quantity of moisture into the charcoal, and so reduces its thermal efficiency. The condition of the burning heap can be ascertained at any time by thrusting a pointed iron rod through the pile. If it comes in contact with unburned wood the process is not complete, but if no wood is encountered the material is thoroughly burned and the pile is ready to be closed and allowed to cool.

Composition of Cast Iron

In selecting the material for making any given casting a knowledge of the different classes of iron contained in various castings is necessary. Ordinary cast iron contains scarcely more than 94 per cent. iron, the remainder being carbon varying from 3 to 4 per cent., silicon from 1 to 3 per cent., manganese from 0.3 to 1 per cent., phosphorus from 0.3 to 1 per cent., sulphur under 0.1 per cent.

The carbon occurs in cast iron in two forms, known respectively as combined and graphitic carbon. When the carbon is in the combined form it is united with the iron in the form of iron carbide and this makes the metal hard, white and brittle. In the face of chilled car wheels the carbon is practically all in the combined form.

The graphitic carbon is present as flakes of graphite mechanically mixed with other constituents of the metal. The percentage of graphitic carbon and the arrangement of the grains affect to a large extent the hardness of the casting. In all soft, gray cast iron most of the carbon is present in the graphitic form. If castings are to be machined most of the carbon must be present as graphite. Slow cooling and the presence of a large percentage of silicon tend to throw the carbon into the graphitic form. Sulphur tends to throw the carbon into the combined form. Manganese in itself tends to harden iron, but has an even more marked tendency to unite with sulphur to form manganese sulphide which tends to rise to the surface of the metal and escape with the slag, or, in any event, renders the sulphur less harmful than when it is combined with the iron. For this reason the presence of manganese up to 0.7 per cent. is advantageous in castings. With ordinary sulphur percentages if the manganese is higher than this it has a tendency to harden iron.

Making Valve Heads and Rings

By C. E. Paddack

Details of the practice of a Western shop for finishing valve heads, valve rings and valve-chamber bull rings.

There are many ways of machining valve heads, valve rings and bull rings, but the way we turn them on a Bullard vertical turret lathe may be of interest to the readers.

A piston-valve head, sometimes called a spider, is shown in position in Fig. 1, and on account of the thin flange it must necessarily be set very high in the chuck jaws, and be held very lightly. To machine, proceed as follows: With roughing tool in side turret head run rough cut down the outside of the spider, and while this is feeding down, face off boss in center of spider. This last is not necessary, but makes it much nicer to start the boring tool and drill. Next bring boring bar in vertical head into position and start a cut in the hole. After roughing cut of side head is down to flange, draw the tool out and start rough cut to face off flange. Then after this has fed in, disengage the feed and withdraw the tool. Change the speed of the table to accommodate the small boring tool, and after this cut has run through, raise the tool and run a second cut down an inch or more to insure the two-inch drill running true and apply fine feed. The use of this drill serves two purposes, removing the stock and sizing the hole.

Reduce the table speed to accommodate the tools in the side head and with tool No. 2 run an intermediate cut, as shown in the halftone. As this tool is almost square it can be used to face flange and square out corner, after the two intermediate cuts are finished. A finishing cut can be run down the outside and over the flange with finishing tool No. 3 in the side head, and by the fime the cuts are finished the drill will have fed through; then raise the drill and use the rough facing tool in the vertical head to face off the top of the outside of the spider, making it the proper hight from the flange, thus completing the first setting of this casting.

As each cut is made on the first one the observation stops should be set for machining of other castings.

A second setting is necessary for completing the machining of this casting, which consists of turning it over and setting it central in the same chuck, no change of arrangement of tools being necessary for finishing, as the facing tool in the vertical head may be facing the flange, while the tool in the side head is turning the outside diameter. When these cuts are finished, withdraw the tools and speed the table up to face off the boss in the center, which will complete the job.

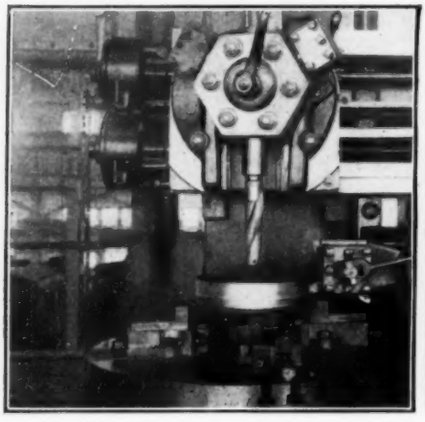


FIG. 1. TURNING A VALVE HEAD

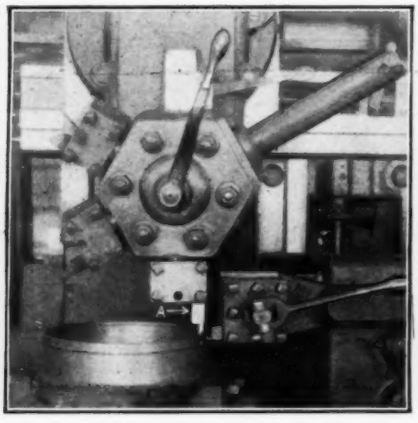


FIG. 2. MACHINING SINGLE OFFSET RINGS

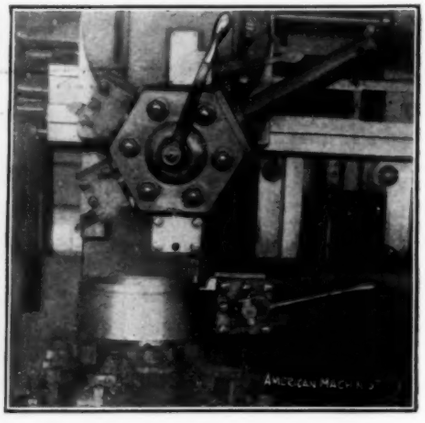


FIG. 3. MACHINING DOUBLE OFFSET RINGS

TURNING VALVE RINGS

The method of turning single offset valve rings is shown in Fig. 2, and it can be seen that the casting is chucked in chuck dogs made expressly for packing, which have been described previously.

Having the casting properly chucked, set a rough facing tool in tool holder No. 1 and bring it into position as if to face off about ½ inch of the top of the casting, and after feeding in just enough to break the corner well, raise it enough to face off the top of the casting, this plan removing the scale yet keeping the point of the tool sharp.

Next bring the long boring bar into position and start the cut as soon as the feed is applied, the roughing tool in the side head also being brought into position and the outside cut started. After the roughing cuts are made, finishing cuts may run in just the same manner, after which bring the tool holder No. 2 of the vertical head in position and set a finishing tool about ⅝ inch wide in it to face off the top of each ring. Set it just ¼ inch above the top of the casting, then after locking the slide binder, turn the turret and set a tool like the one at *A*, just touching the top of the casting, which will make the ¼-inch offset desired. To cut off the rings use a narrow parting tool, as shown.

By setting the parting tool in the upper side of the turret head, more than one-half of the rings may be cut off before having to put it in the lower side of the turret, which gives room to turn the vertical turret without having to run it in and out to make the tools clear the side head, as is necessary when cutting off the lower rings.

After the parting tool has been set a full ⅝ inch below the top of the casting and fed in about $\frac{1}{16}$ inch, bring the facing tool in the vertical turret into action, facing off the top of the ring until it gages properly. Lock the vertical slide binder and turn the turret to bring the tool in holder No. 3 into cutting position, engage feed and allow it to feed out full ⅜ inch, which will make an offset ¼x⅜ inch. Set the observation stops for the cross feed, making it necessary to measure only the first casting.

With good iron the rings need not be faced.

DOUBLE OFFSET VALVE RINGS.

It will be seen that the casting for double offset valve rings, shown in Fig. 3, is in the four-jawed chuck that came with the machine, which is on account of the small inside diameter.

On account of its setting high in the chuck and to make it absolutely secure,

use two toe clamps on opposite sides of the casting, as shown, giving rigidness without squeezing the casting unnecessarily hard. Machine this casting the same as the one just described until the cutting off of the rings commences, then change the tools in the vertical turret to give ⅛ inch instead of ¼ inch offset, this ring having ⅛ inch offset on top and 1/16 inch underneath.

By starting a 3/32-inch parting tool from the outside 2/16 inch from the top, and allowing it to feed in 5/16 inch, the indicator stop can then be set for this tool.

The top of the ring can be faced to the gage and the turret turned, bringing the tool for cutting the offset into service. When the parting tool has fed in its 5/16 inch it must be withdrawn, so the turret can be turned just half over. Then set another parting tool in the side turret so it will be just 1/16 inch lower than the other one and so that it will not be necessary to cut any farther than from where the previous tool left off.

The difference of the amount of the offset 1/16 inch plus 1/64 for clearance underneath makes the second tool take hold the same as if it were started from the outside. The latter parting tool will not have time to cut the ring off before the proper offset is made by the vertical head.

Valve-chamber Bull Ring.

The bull ring, shown in Fig. 4, is for a 14-inch chamber, and it is recessed or cored out on the inside, which makes it exceedingly light, weighing only 10 pounds when finished. It can be chucked to a very good advantage for boring the inside, facing the top edge and ring bearing on the upper side.

For machining the first part of the bull ring use a rough facing tool in the vertical turret to first break the scaly corners and face off the top edge; then bring the boring bar into position and start a cut with it, and while this is feeding down the roughing tool in the side head may be brought into service after setting it almost ⅜ inch below the top, to face off the ring bearing and run a rough cut down the outside of the ⅜-inch projection.

The two later cuts and boring cut will run out about the same time. Intermediate cuts can be taken next, by first starting the boring bar in again and then with the finishing tool in the side head, run a light cut over the ring bearing, allowing this tool to feed straight in until it makes the ⅜-inch projection the proper diameter, thus serving three purposes at one setting: that of making the intermediate cut on the ring bearing, the finish on the projection and the squaring of the corners, which finishes the work of the side head, after which it is only necessary to run a finishing or sizing cut on the inside with the second boring bar, and with the narrow finishing tool in the tool holder run a final finishing cut over the ring bearing and top of the projection to make these two parts gage properly.

As each cut is taken the observation stops are set as in the previous examples.

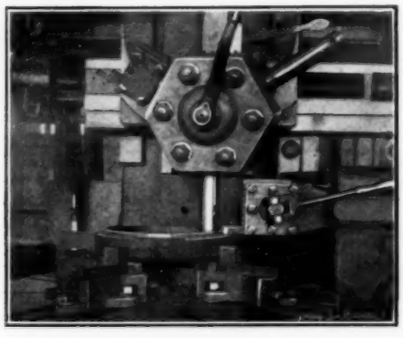


Fig. 4. Bull Ring Chucked for Inside Finishing

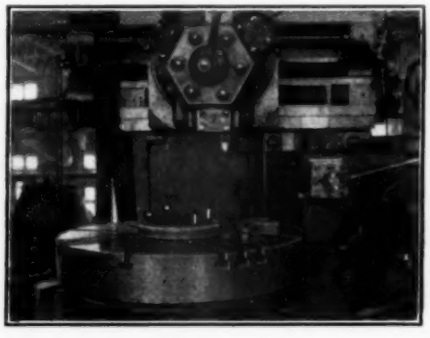


Fig. 5. Mandrel for Holding Bull Ring While Turning Outside

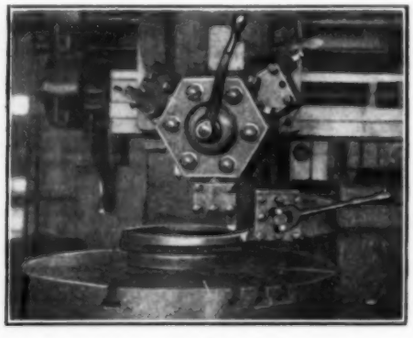


Fig. 6. Method of Finishing Outside of Bull Ring

For the second setting of the bull rings remove the chuck and put the bull ring on the mandrel, shown in Fig. 5. This mandrel is very plain and inexpensive, being made of a round, flat piece of cast iron with a boss projecting down ⅜ inch, which is turned to fit closely into the table center. It has four holes for ¾-inch bolts to come through, with which to bolt it to the table, and has the outside turned 12⅝ inches, with a ¼x¼-inch offset cut in to give a bearing and a close fit for the inside of the ring.

To hold the bull ring on the mandrel it is only necessary to use four small clamps, as the mandrel has slots in it for the bolts to come through, and is fastened down only when the bull ring is clamped, the clamps being engaged in the recess on the inside of the ring, which keeps the nuts about even with the top. As all the clamping force is downward, there is no occasion to either spring or expand the ring, and all of the stock may be removed at one cut with as much as 1/16 inch feed without slipping. As will be seen from Fig. 6, the roughing tools are first used to turn the outside and face off the top. To avoid guessing at the proper thickness I have a round piece of steel 29/64 inches length, which when set on end on the mandrel inside of the bull ring, may have the roughing tool in the vertical head run down to just touch it, which will leave 1/64 to face off with the finishing tool. With the tool thus set, feed out, as it gives more room for side head and avoids rough edges on the ring. As this cut will be of very short duration the tool in holder No. 2 can be set to feed down, sizing the outside of the ⅜-inch projection, and will run out just a little sooner than the one of the side head, when there will be room for this tool to be brought out and started over to face off the ring bearing.

As the ring bearing is the same width as the tool, the cut will have to be finished before a finishing tool can be started on the outside. After the finishing tool in the side head is engaged in taking the first of two cuts, of which I always run one as an intermediate and one as a sizing and finishing cut, the vertical turret may be turned again, bringing the narrow tool in holder No. 3 into position to face off the top of the ⅜-inch projection to gage. As this tool is only ⅜ inch wide, it can be used on the ring bearing after the finishing tool in the side head is down just below the ring bearing, or, after it has fed in ⅜ inch, the last cut with the side head may be started, which will finish this side of the ring.

While this is a very tedious job, it will be found less so by the use of the mandrel and the ease of handling the machine with both heads operated from the same side of the machine is a decided advantage.

The prime object which the originators of the German social relief system for workers had in mind was an efficient and prosperous nation. This object seems to have been accomplished.

Engineering Education in China

By F. A. Foster*

Not all of the awakening of China is confined to political questions, the growth of practical engineering education being shown by this article.

That the introduction of new methods is made easier by following the lines of least resistance is clearly shown in the case of the old locomotive illustrated.

*Instructor, mechanical engineering, Tangshan College.

It is apparent that China is fast waking up to the advantages of many Western ideas. The existence of such a school as the Tangshan Engineering College, where I am teaching, is a good illustration. The college was established by the Imperial Chinese Railways in 1905. In May of that year instructions were received by the directors of the railways from Their Excellencies Yuan Shih-kai and Hu Yen-mai, directors-general of Imperial Chinese Railways, to draw up plans for an engineering college to be established at some point along the railway line where Chinese engineers were to be trained for service in the railways. In August of the same year Tangshan, half way between Tientsin and Shanhaikan, was decided upon.

The railway workshops in Tangshan offered unusual opportunities to the students for practice in connection with their engineering education. Building operations were begun in October, providing dormitories for 160 students, a dining hall, two class-room buildings, a swimming pool, and residences for the president and the professors. These buildings were completed and ready for the reception of students in August, 1906. For the first class, students with a working knowledge of English, elementary mathematics, and Chinese literature, history and geography were examined in Hongkong, Shanghai and Tientsin, in December, and 120 were chosen. Regular class work, however, did not begin until March, 1907, when the students were divided in two sections of 60 members each.

The two class-room buildings, originally provided, soon proved insufficient for the accommodation of the several departments, and a larger lecture hall containing drawing offices, laboratories and lecture theaters was further added. This building, now known as East Hall, was begun in May, 1907, and was ready for occupation at the end of the year. At the same time a hospital for the special care of sick students was built on a lot adjoining the college compound.

FIG. 1. ENGINEERING COLLEGE AT TANGSHAN

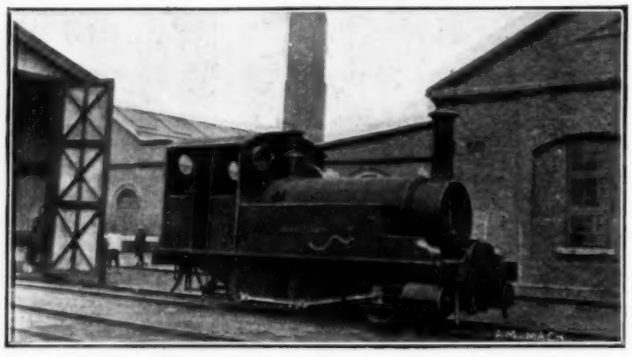


FIG. 2. A PIONEER LOCOMOTIVE IN CHINA

FACILITIES BEING IMPROVED

During the first two years of the college's existence, the classes were handicapped by lack of equipment for practical work, but greater emphasis has since been laid on practical laboratory work in connection with lectures and textbook instruction and now there have been added several large buildings which are gradually being supplied with machinery and apparatus for practical work. The workshop of the mechanical-engineering course remains to be fully equipped, a comparatively small equipment having, as yet, been installed.

The original plan of the directors-general of the Imperial Chinese Railways was to train Chinese engineers for railway-construction work only, and a course in civil engineering was offered in the college. When the Imperial Chinese Railways became the Imperial Railways of North China and came under the control of the Ministry of Posts and Communications, the college also came under direct control of the ministry and now, courses in mechanical and electrical engineering are added to train men for these branches of engineering, as well.

The college aims to offer to students the highest engineering education obtainable in the country. Students graduating from the engineering courses are to be employed by the Ministry of Posts and Communications and drafted into the various government railways to serve as cadets for a term of two or three years before they are given definite posts on the engineering staff. The first class to graduate was that of this year, in July. Although the standard, as yet, is not as high as in similar schools in Europe and America, still, considering all the conditions, it marks a great and important step in advance, which will be a great help in bringing the nation forward a long distance.

Public schools are being established all over the land and a central board of education has control of the movement. The old idea of merely a literary qualification for officials has vanished and the ancient examination halls are discarded, nevermore to be used for that purpose. It is not to be inferred, however, that all the old has disappeared. Far from it. It would not be safe or healthy for any nation, as a whole, to make too sudden a change in such matters. The changes are coming quite fast enough for the good of the country and the people.

USE OF FOREIGN GOODS GROWING

It is surprising, however, to go into a Chinese village store and see what a lot of foreign things are on sale there and used by the natives. Sewing machines, cameras and photographic goods, clocks, lamps, toilet articles, tools, various kinds of cloth, canned goods of all kinds, cigarettes and patent medicines. Bicycles are used quite generally in the larger towns, and there are a few motor cycles and an automobile owned by a native even in this small place.

There are immense possibilities for good to the world at large, concealed and undeveloped as yet here in China. The people have some strong moral traits that the new civilization may bring

out, if the so called civilized nations live up to their highest ideals, in their dealings with the great Middle Kingdom. The Chinese as generally seen in America and as represented by the yellow journals, are not truly representative of the people of the nation here.

Students Serious and Ambitious

I find the Chinese students, as a rule, very earnest, industrious and ambitious. They are inclined to be almost too serious and industrious for their own good.

Through the efforts of our college physician, Doctor Jee (Chinese, and a graduate of Harvard), the students are developing quite an interest in the open-air athletics. We have a fine campus and a large field for football, tennis and similar games. We have also a fine running track. Last May we had our first athletic field day, which was a great success, athletically and socially.

Railroad building is progressing quite encouragingly at present. The government has bought up several of the roads which were originally built by foreign capitalists and is trying to put them in first-class condition, and with considerable success. In such cases the foreign engineering force has been retained for a while and foreign help is required in the building of new lines. There are a few notable exceptions to this, however, in lines built and engineered almost, if not entirely, by native, foreign-educated engineers.

The government has recently issued a proclamation declaring, in a general way, its railway policy. It seems to be the plan for them to build, own and control the main lines of road, leaving the branches and less important lines to be built by private effort. It is proposed to establish a trunk-line system running north and south across the country and also east and west. In this way they hope to get an important system into working condition in much quicker time than if it were left to local and private effort.

A Pioneer Chinese Locomotive

The accompanying illustration shows an interesting old locomotive, called "The Rocket of China," named after the famous old English locomotive. It has rather an interesting history.

In 1878 the China Merchants Steam Navigation Company had grown to such an extent that it was desirable for them to get some supply of coal in Chinese territory. They had been getting it from Japan, that being the only near supply. There were large coalfields in the vicinity of Tangshan, some 80 miles northeast from Tientsin, known as the Kai Ping coalfields, but they had never been utilized on a commercial scale. An attempt was made to get governmental sanction to build a railroad from this coalfield to tidewater at Pehtang, the mouth of the Pehtang river, some 29 miles away. This, however, was unsuccessful.

At that time railroads had not met with any success in China, there being strong opposition to them on a variety of grounds. Instead, therefore, of building a railroad, the progressive Chinese merchants who were backing the enterprise were obliged to build a canal from a place about five miles from the coal mine, to Pehtang and haul their coal to the head of the canal in mule-drawn cars on a narrow-gage railway.

This state of affairs was intolerable, however, and Tong King Sing, the head of the company, finally decided to substitute a small locomotive for the mules, hoping that, in the course of time the opposition would wear away, as the people became familiar with the small beginning, thus opening the way for a further extension of the line as a substitute for the canal. Quietly the narrow-gage tramway was widened to the standard width of 4 feet 8½ inches, and at the same time Mr. Kinder, the resident engineer, began to look around for available material for a locomotive.

This he found by taking the boiler and cylinders of an old upright hoisting engine. For wheels he was fortunate in getting some ordinary cast-iron car wheels from a scrap-iron pile. For these important elements he had a suitable frame made from channel iron from the headgear of the No. 1 shaft of the mine. The cost of construction was 520 Mexican dollars, something between $300 and $400, gold, including labor and all but old material.

Burying the Locomotive

The government officials at Peking got wind of what was being done and ordered the work stopped. Further complaints having been sent up to Peking by the opposition, a commission was appointed to come to Tangshan and investigate. There was some delay in their getting there and as warning had been received, the locomotive was buried in the ground. When the royal commission came there was no locomotive to be found and the commission returned and so reported.

It can easily be imagined that there were those on the commission and in influential places in the capital, who were favorable to the movement on foot. After considerable negotiation with Li Hung Chang, who was at the head of that portion of the government with which they had to deal, they judged it was safe to dig up the monster and restore it to life once more. The locomotive was, therefore, put to work on the few miles of tramway from the mine to the canal head. No serious opposition occurring, the road was extended a little further to connect another mine.

Gradually the value of such a road was appreciated by its former opposers and it began to appear to the government that it would be a good thing for them if they had such a railroad to Shankaikwan, the point on the coast where the Great Wall meets the coast, and where there is a gate of entrance into the country, enabling them to quickly transport troops there from the capital. In this way the opportunity came to the originators of the road to further extend its usefulness and with the sanction of the government, instead of its opposition.

From this small beginning the present efficient system of railways of the government was built up, until now there are several thousand miles of road already built and many more in contemplation.

Where Tact Won Out

Two things are illustrated in this incident. Firstly, it illustrates the sound diplomatic principle of applying the thin edge of the wedge in dealing with Chinese official classes. Secondly, it shows the good results of tenacity of purpose, a requisite of great importance in dealing with deep-seated prejudice.

These things show how the country is advancing. Naturally, it is hard for people in America to realize how much improvement is being made here. The old ideas of conservatism and exclusiveness of China are still prevalent there as they are here, but not to so great an extent as formerly. The country certainly has its eyes open and is trying to find what is best to be done.

Using Rosin Paper While Babbitting

By A. N. Hammond

Articles on babbitting have proved interesting and some have novel features. However, no one has mentioned the use of rosin paper on the mandrel to give correct clearance. I have poured many a large journal, after wrapping the mandrel with rosin paper and used it without machining or scraping.

For repair work a fairly heavy string or small rope can be wound around the mandrel to form right and left oil grooves.

The small-sized gas engines built both in England and on the Continent embody many fine features of construction. As a rule, the frame is massive and heavy flywheels are also provided. The valve gear is mechanically controlled and the ignition is generally of the magneto type with a battery for starting. Many different methods of governing are employed, some of them of very interesting construction.

The Art of Die Casting*

By Amasa Trowbridge†

The art of die casting, originated about 1735, has evolved wonderful methods of producing large quantities of finished castings accurate in size and correct in shape.

The metals and alloys that are suitable for this work.

Some comparisons of costs.

*From a paper presented before the American Society of Mechanical Engineers.

†Factory manager, Veeder Manufacturing Company, Hartford, Conn.

The art of die casting, that is, the making of castings in steel molds to finished size and shape, was first introduced in connection with the manufacture of type. The first attempt at typefounding was made in France, followed shortly by manufacturers in other countries. The first successful attempt in the United States was about 1735. As soon as it was established that finished type could be cast in steel molds, inventors naturally turned their attention to machines for doing the work. Such machines were attempted early in the 19th century, and by the close of that century the perfected linotype and monotype machines, which are fine examples of die-casting machines, had been evolved. Machines for casting individual pieces of type are also still in use, and the most recent ones will cast about 125 to 150 pieces per minute. This gives some idea of the speed with which such castings can be made.

When the casting of type was perfected, it saved so much time that its usefulness for making other pieces which were wanted in large quantities was at once evident. Accordingly many men have made efforts to perfect a machine or process by which they could turn out finished castings correct as to size and shape. Since type was first successfully cast it is natural that the same methods should be used for making other castings. So far no material superior to steel, the material used for type molds, has been found for making the matrices, or dies, as they are called. Brass can be and is used where the casting is very intermittent as in a linotype machine, but for continuous work and where accuracy and truth are required, steel is necessary.

The Material for the Castings

The next consideration after the material for the dies is that for the castings. There are only a few common metals with a melting point sufficiently low to be cast in steel dies, because these do not have to be brought to their melting point to be spoiled. If improperly treated in making, the dies are very susceptible to injury in use. Fine cracks are sometimes made in hardening the dies, causing them to break when subjected to the constant change of temperature which occurs in their use. Thin places in dies are more apt to get burned than heavy parts. For most work hardened dies are superior to soft, but their cost is very much greater.

In general, the method of making a casting is as follows: A suitable die or mold is made in steel. This must be so arranged that when opened the casting will either drop out or be easily ejected. The die should have the fewest possible partings. This is important because it is easier to hold the casting to correct size when the die is in a few pieces than when it is in many. Also, the fewer the partings the fewer the fins that will be made on the castings.

Whenever cores are necessary, suitable means must be provided for withdrawing these without deforming the casting. The die must close properly, that is, in correct alinement, and be held firmly because the pressure of the fluid

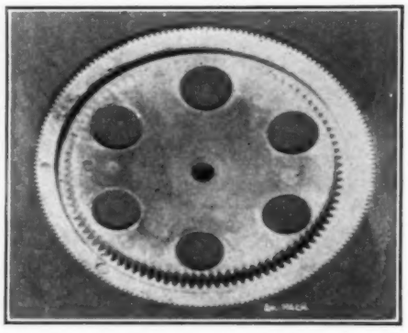


Fig. 1. An Internal Gear

metal has to be overcome. The die being held closed in the machine, metal is forced into the die, pressure being provided by a pump which acts directly on the metal, by air pressure on top of the molten metal, or by a head of molten metal. The metal is allowed only to set. The mold is then opened and the casting removed, the casting being left in the mold only as long as is absolutely necessary. If the die is too hot, it is then cooled and the operation repeated. The temperature of the die is important, and should be held constant because the expansion of the die will change the size of the casting. This operation is generally carried on in so called hand-casting machines, that is, machines operated by manual labor.

Automatic Machines

Automatic machines are in use and have great advantages in producing uniform castings because the conditions do not vary. The automatic machine is run at a constant speed and is not subject to varying conditions due to the operator's becoming tired. Hand-casting machines produce quantities of 500 per day, more or less, depending on the size and complexity of the piece. Automatic machines produce the castings much more rapidly and save on labor just as does any other type of machinery.

[The principles involved in casting machines were described and illustrated in the American Machinist, Volume 31, Part 1, at page 227, "The Method of Producing Die Castings," by E. L. Lake. —Editor.]

Advantages of Die Castings

The feature about die castings which most appeals to the manufacturer is their accuracy. So long as the dies are in good condition the castings should be perfectly true, both in size and shape. This does away with the necessity of gaging and makes it possible to use them without their having to be fitted into place by any hand work. A careful inspection is necessary, and this should be done as soon as possible after the castings are made so as to detect any flaws due to a slight failure of the dies. Any fins or burs formed by the necessary joints in the dies can be removed at the same time that the castings are inspected. Usually these fins are not thick and can be taken off thoroughly and quickly with a light hand tool.

A difficulty due to shrinkage is sometimes encountered when these castings are to be used in connection with parts made by some other process. While the shrinkage will be the same in two castings made in the same die if the metal is properly handled, it does not always follow that it is proportionately the same when they are made from different molds. It is affected to a marked degree by the form of the casting, and if the castings are to be used in connection with machined pieces, it is advisable that these be machined to fit the casting. When it is not possible to do this and the casting must be fitted to existing pieces, sample castings should be made, and if these are not correct, the dies can be altered to make castings that are correct. In doing this, sufficient material must be allowed for grinding away, the casting being at first too small, although this makes a great deal of extra work.

The greatest gain obtains when an

entire machine can be made of such castings. One of the best examples of this is the Veeder cyclometer so universally used on bicycles. This instrument is composed of about a dozen die castings and nearly as many parts of other materials. The number rings have 0.001 inch play, and yet these castings are made in enormous lots and, without being gaged, are assembled into the die-cast cases where they fit and work properly. So exact are these castings that when new, the instruments work more easily without lubrication than with it. This would obviously be possible only where the clearances are extremely small. A small dimension on these castings can be maintained to 0.0001 inch.

The Alloys Used

The quality of these castings depends on both the alloy used and the method of making them. The alloys in most common use are those having a zinc base. This metal is useful in certain alloys, particularly with copper, but if alloyed with aluminum is unsuitable for most purposes. Aluminum-zinc alloys are frequently used because aluminum makes the alloy lighter in weight and in color. Some time after manufacture, castings of this alloy begin to disintegrate and will actually fall to pieces. In the disintegrating process they also change shape badly so that they should never, under any circumstances, be used for pieces which are wanted to stay flat or true. This alloy also tarnishes rapidly. Most of the alloys of zinc are too brittle to be of much use for the making of die castings. The usual effect of casting in metal molds is to make harder castings than would be made from the same metal in sand molds. For this reason a fairly ductile metal should be used.

The alloys of tin are being used quite extensively for die castings. These alloys possess the two desirable qualities of being quite ductile and of melting at a low temperature. Genuine babbitt metal, as it is commonly called, is an alloy consisting, according to the best authorities, of about 89 per cent. tin, 7.3 per cent. antimony and 3.7 per cent. copper. This is a remarkably fine bearing metal and is possessed of sufficient strength to make it useful for many small parts. By certain changes in the alloy a composition even better for ordinary die-casting use can be produced.

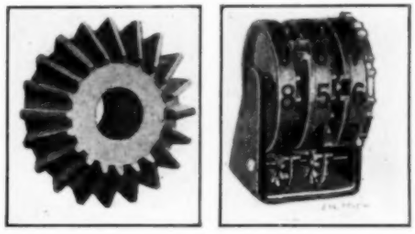
The alloys of lead are used to a limited extent, but, except for type, this metal is more often used in a small proportions than as the foundation of the alloy. It is too heavy and lacks sufficient strength to make a very desirable metal. The percentage of lead in an alloy is sometimes increased for the sake of lowering the melting point and the price per pound.

Antimony is a common constituent of all die-cast alloys. The addition of this metal in the proper proportions, makes the alloy hard enough to machine well and increases the fluidity of the metal in its molten state. This makes it possible to obtain sharp castings such as are made from type metal, which is an alloy consisting of lead, 87½ per cent., and antimony, 12½ per cent.

In making an alloy of any two metals, when they are in correct proportions, there is formed an eutectic, the melting point of which is lower than that of either of the constituent metals. In some cases by the addition of a third metal, the melting point may be still further lowered.

The Strength of the Castings

The strength of die castings is, of course, largely dependent on the alloy, and also on the method of casting. Unless proper precautions are taken to insure sound castings, much trouble will be encountered from blow holes. To prevent these is often very difficult and sometimes impossible. They are caused both by the form of casting and by the tendency of the molten metal to hold



Figs. 2 and 3. Other Products of Die Casting

minute bubbles of air or other gases which are carried into the mold and do not escape before the casting sets. This is a case exactly parallel to that found in making iron castings. The shrinkage of the ordinary die casting is not as great as that of cast iron, and some of the tin alloys particularly shrink scarcely at all.

Another similarity to iron molding is found in the fact that the outside skin of the die casting is ordinarily stronger and harder than its interior. The hard outside skin is always desirable on a die casting, because the piece being cast to its finished size and no cutting being required, it is this outside skin which is first subjected to wear.

Exact figures on the strength of die castings might be quite misleading unless the exact composition and treatment of the castings were noted, so that general figures only can be given. They compare very favorable with cast iron in tensile strength, but are not nearly so strong in compression as that material. Their compressive strength is usually but little greater than the tensile, although it is somewhat, say one-third, greater. As the material is not as brittle as cast iron, it can be subjected to shocks which the iron would not withstand. Most die castings are much more ductile than cast iron. The greater ductility of the die castings is an advantage for threaded or tapped pieces. The castings do not chip out when tapped near an edge and a fine thread may be used. Some of the alloys are so ductile that the castings may be spun or riveted. This is often needed or is convenient for fastening two castings together or fastening a casting and some other piece.

The Question of Costs

Very little idea can be given of the cost of parts manufactured by the die-cast method. The tools or dies are costly or otherwise, according to their complexity or their simplicity. Practically all the die-casting manufacturers make the customer who ordered the castings pay for the dies. The parts are then charged for according to the time needed to cast them and the amount of metal used. As only the metal in the finished casting is charged for, there is no expense for scrap. The time for casting a complicated piece is little, if any, greater than for a simple one. From this it follows that the more complicated the casting, or the more difficult it would be to machine, the greater will be the saving effected by the use of die castings. The number of pieces to be made from a die is also pertinent, for hundreds of thousands of pieces can be made from some dies with no injury whatever to them. Other dies may need frequent repairs due to unavoidably weak points in their construction. Number wheels having internal or hooded gear teeth are good examples of parts which are profitably made by this process.

The necessary die for the internal and external gear, shown in Figs. 1 and 2, would cost about $100 for a hand-casting machine, and the castings about 13 cents each in 10,000 lots. The dies for the same piece to be used in an automatic machine would cost about $450, and the castings would cost about 2 cents each in 10,000 lots, plus 8 to 9 cents each for metal. The bevel gear illustrated was made in a hand-operated machine of a zinc alloy, commonly known as hard metal. A die for this costs about $90, and the casting 7½ cents each in 1000 lots, and 6½ cents each in 10,000 lots.

The set of number wheels and pinions shown in Fig. 3 will serve as a fair example for the comparison of costs by hand-casting machines and by automatic machines. The dies for this set of wheels and pinions for a hand machine would cost in the neighborhood of $450. The number-wheel castings would cost, in lots of 1000, about 10 cents each, and in lots of 10,000, about 8½ cents each. The pinion castings in lots of 1000 would be 4 cents each and in lots

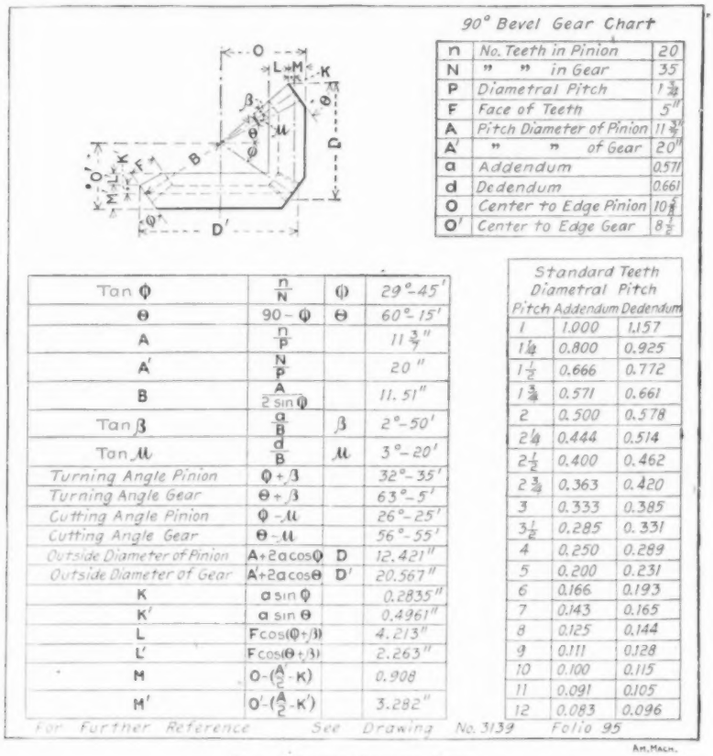
of 10,000 would be 3 cents each. The cost of the dies for an automatic machine for the same wheels and pinions would be about $2000. The number-wheel castings in lots of 10,000 would cost about 2½ cents each, and in lots of 25,000 or more about 2 cents each. The pinion castings would cost about 1½ cents in 10,000 lots, and in 25,000 or more lots, about 1 cent each.

Easy Method of Figuring Bevel Gears

By H. P. Reston*

In the routine of work in the drawing office, the figuring out of bevel gears often proves a prolonged task for the average draftsman. To save time and to have a systematic way of obtaining results, the above chart was compiled for use in the Cincinnati Planer Company's drawing office. Blueprints are made and are filled in when required.

The operations in calculating are given in regular order, and the results are placed in the blank spaces provided. When the charts are filed together it is an easy matter to look through the data in the top right-hand corner in case similar gears can be used for other designs.


90° Bevel Gear Chart
n No. Teeth in Pinion 20
N " " in Gear 35
P Diametral Pitch 1 3/4
F Face of Teeth 5"
A Pitch Diameter of Pinion 11 3/7"
A' " " of Gear 20"
a Addendum 0.571
d Dedendum 0.661
O Center to Edge Pinion 10 5/8"
O' Center to Edge Gear 8 7/8"
Tan Φ n/N Φ 29°-45'
Θ 90 - Φ Θ 60°-15'
A n/P 11 3/7"
A' N/P 20"
B A/2 sin Φ 11.51"
Tan β a/B β 2°-50'
Tan μ d/B μ 3°-20'
Turning Angle Pinion Φ + β 32°-35'
Turning Angle Gear Θ + β 63°-5'
Cutting Angle Pinion Φ - μ 26°-25'
Cutting Angle Gear Θ - μ 56°-55'
Outside Diameter of Pinion A+2a cos Φ D 12.421"
Outside Diameter of Gear A+2a cos Θ D' 20.567"
K a sin Φ 0.2835"
K' a sin Θ 0.4961"
L F cos(Φ+β) 4.213"
L' F cos(Θ+β) 2.263"
M O-(A/2 - K) 0.908
M' O'-(A/2 - K') 3.282"
Standard Teeth Diametral Pitch
Pitch Addendum Dedendum
1 1.000 1.157
1 1/4 0.800 0.925
1 1/2 0.666 0.772
1 3/4 0.571 0.661
2 0.500 0.578
2 1/4 0.444 0.514
2 1/2 0.400 0.462
2 3/4 0.363 0.420
3 0.333 0.385
3 1/2 0.285 0.331
4 0.250 0.289
5 0.200 0.231
6 0.166 0.193
7 0.143 0.165
8 0.125 0.144
9 0.111 0.128
10 0.100 0.115
11 0.091 0.105
12 0.083 0.096
For Further Reference See Drawing No. 3139 Folio 95
Am. Mach.

The Chart Filled Out

Molding with a Dry Sand Core

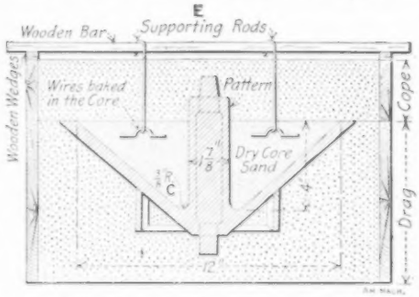
By M. J. Elder

The following describes how the inside or cope of the pattern, a sketch of which is shown herewith, was molded in a dry-sand core, and why it was a puzzle to the man who made the pattern.

The pattern was made to be molded without a core in green sand, but on account of the underhanging body of sand, the molder thought it best to take no chances, so concluded to make the mold with a dry-sand core, as shown.

Why was this pattern made to be molded in green sand if it could not be molded that way? This is a perfectly proper question for any mechanic to ask. Like many another man in the trade, this patternmaker did not learn foundry practice in connection with the wood-working end of the patternmaking trade. I mention "wood-working end" because the boy or man who knows little or nothing of foundry practice cannot be classed as a first-class patternmaker.

Patterns made to be molded in green sand very often are made all or part in dry-sand cores without any provision for the cores being made by the pattern-maker. This class of molding is something of a puzzle. When only one or two castings are wanted a molder will seldom refuse to do a job on account of the construction of the pattern, but if a pattern is to be standard it is always well to consult with the foundry man before making it.



Mold Using a Dry-sand Core

In the sketch is shown what is known in brass, rolling-mill work as a common, mold-runner box, which serves the same purpose in the mills as the pouring basin in an iron-foundry mold.

Owing to the shape and depth of the underhanging sand in the cope, the foundryman saw that this would require a cope flask fitted with special sand bars or rings of wood in order to secure and support the sand, also that the sharp ring of sand at *C* must be secured to guard against the molten metal dislodging or breaking it away, thus spoiling the mold and producing an imperfect casting. To prevent any accident and to insure a good mold and cast every time, we made the underhanging body of sand in a dry-sand core, securing it to the green sand in the cope by means of the wire rods *E* and a wooden bar, the latter resting on the sides of the flask, thus making the green and dry or baked sand one body of cope sand. How this is done is clearly shown. However, a few words about this method of coring may be of interest.

As there is no core box the pattern is used to make the dry-sand core. This is baked and put back into the pattern to be rammed up with the cope; that is, it is supposed to go back into the pattern but it does not, for during the process of baking the core has swelled or expanded. It must be filed until it goes back into its place in the pattern, that is, the top face of the core must be flush with the ring face of the pattern. The cope is put on the supporting rods *E* and the cross bars are placed. The cope is then rammed, lifted, and the pattern withdrawn. Next the cope is closed down, and everything is ready for the iron. In this mold there is no loose sand to drop down into the mold or to be washed away. This is one way for doing this class of work, which is well for the patternmaker to know, though it has one bad objection—the filing and fitting of the core into the pattern.

To overcome this objection the job in question was done as follows: The mold, core, etc., were made as before, but instead of filing and fitting the core into the pattern, the pattern was filled with molding sand flush with the top or parting face, flour was sprinkled on the edge of the pattern, the cope was rammed up, lifted off, and placed on a pair of wooden horses with the parting fact up. The dry-sand core was next placed in position as indicated by the ring of flour on the edge of the pattern and secured as before. This does away with all filing and fitting, and for general foundry work is quite satisfactory.

*Chief draftsman, Cincinnati Planer Company.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Solid Swaging Hinge Bosses

The piece shown in Fig. 1 is a metal lid of half-hard brass 0.050 inch thick. The bosses are 0.1 inch in thickness or twice that of the lid itself. Fig. 2 shows the blank preparatory to forming.

There is nothing peculiar in the piece, except that the bosses had to be solid and *not* curled.

The first tool made is shown in Fig. 3, and was an utter failure, as far as forming the bosses anything like the required sample.

The tool consists of cast-iron base *A*, carrying a fixed tool-steel hardened and tempered vise jaw *B*1 and also a movable tool-steel hardened and tempered vise jaw *B*2, actuated by the cam lever *C*, pivoted upon the machine-steel screw *D*. The return motion to the vise jaw *B*2 is given by the spiral spring *E*. *F* is the tool-steel hardened and tempered punch.

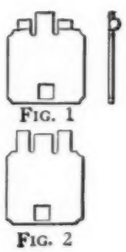


FIG. 1

FIG. 2

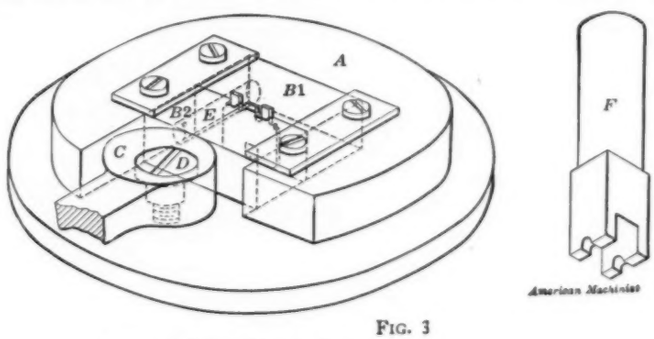


FIG. 3

SWAGING SOLID HINGE BOSSES

The reason for the failure of this tool can be easily seen when we follow its working. In operation the trial blanks were placed upright between the vise jaws *B*1 and *B*2, which were necessarily smooth to prevent damage to the body of the blank. The lever *C* was moved to tighten the vise jaws and the punch *F* brought down upon the ends of the blank. It was supposed to form up the bosses by pressing the ends of the blanks into the recesses of the punch.

In reality no such thing occurred. The metal simply spread or doubled up and a very distorted piece of metal was revealed when the vise jaws were opened and the work taken out. A tremendous pressure would have been required to operate the smooth vise jaws to prevent the body of the blanks spreading under the direct action of the punch, and also there was nothing to hold the metal that was above the vise jaws up to the punch.

After this the tool shown in Figs. 4 and 5 was made and gave excellent results and a neat finished article.

Fig. 4 shows two views of the top tool, one of which is partly in section. It consists of a machine-steel shank *A* holding, by four fillister-headed screws, the machine-steel ring *B*, which carries four tool-steel pieces *C*, *D*, *E*, *F*. Fig. 4, *A* gives an enlarged view of the tool-steel piece *G*, showing how it is built up. *G* is a hardened and tempered tool-steel pad with a positive knockout *H*.

Fig. 5 shows the bottom tool, in two views, the elevation being partly sectioned across the line *X Y* of the plan. It consists of a machine-steel body *A* fastened to the base plate *B*1 by fillister-headed screws. *C* is a hardened and tempered tool-steel punch, a sliding fit in *A*, and actuated by a strong rubber buffer through the machine-steel screw pin *D*. *E* are the forming punches hardened and tempered. *F* is a machine-steel receiver ring and is simply for holding the blanks in position; it is held to the base by three $\frac{5}{16}$-inch screws and returned by three spiral compression springs.

The tool is complete, with studs and adjusting nuts, buffer plates and buffer.

In operation the blanks are placed flat in the receiver *F*, and in the partial descent of the pitman of the power press the ends of the blank are bent up at right angles to the body of the blank, the pad in the top tool *G* giving way and allowing the entry of the blank and punch *C*. In the further descent of the top tool it has to overcome the resistance of the rubber buffer, which is adjusted to give enough pressure to prevent any metal flowing into the lid proper while the punches *E* are forming the bosses. At the end of the stroke the tools give a sharp bump to the entire blank, planishing it and setting up a sharp finish. Although some parts of the tool may seem light, they are not too weak for the work they have to do. In operation all such parts are well supported, and there is really very little pressure required to form the bosses, providing the metal can be made to stand up to the forming punches *E*.

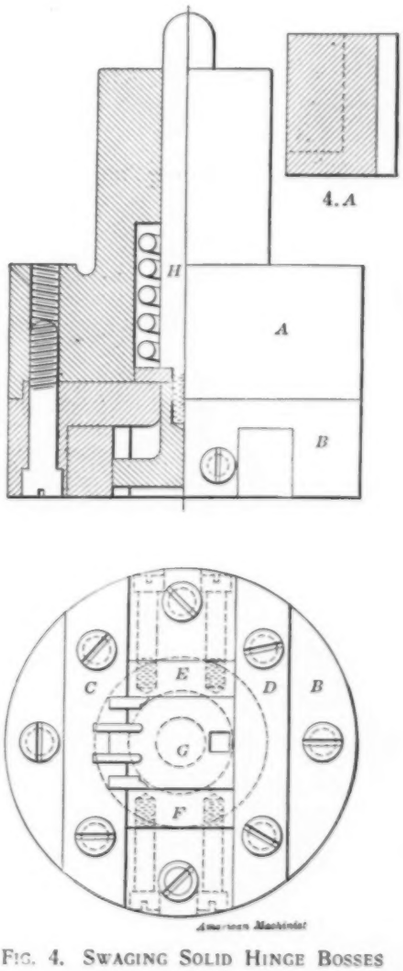


FIG. 4. SWAGING SOLID HINGE BOSSES

An enlarged view of the forming operation, giving a section of the forming tool with the blank bent up and showing that the blank end has no means of escape, is given at *Y*.

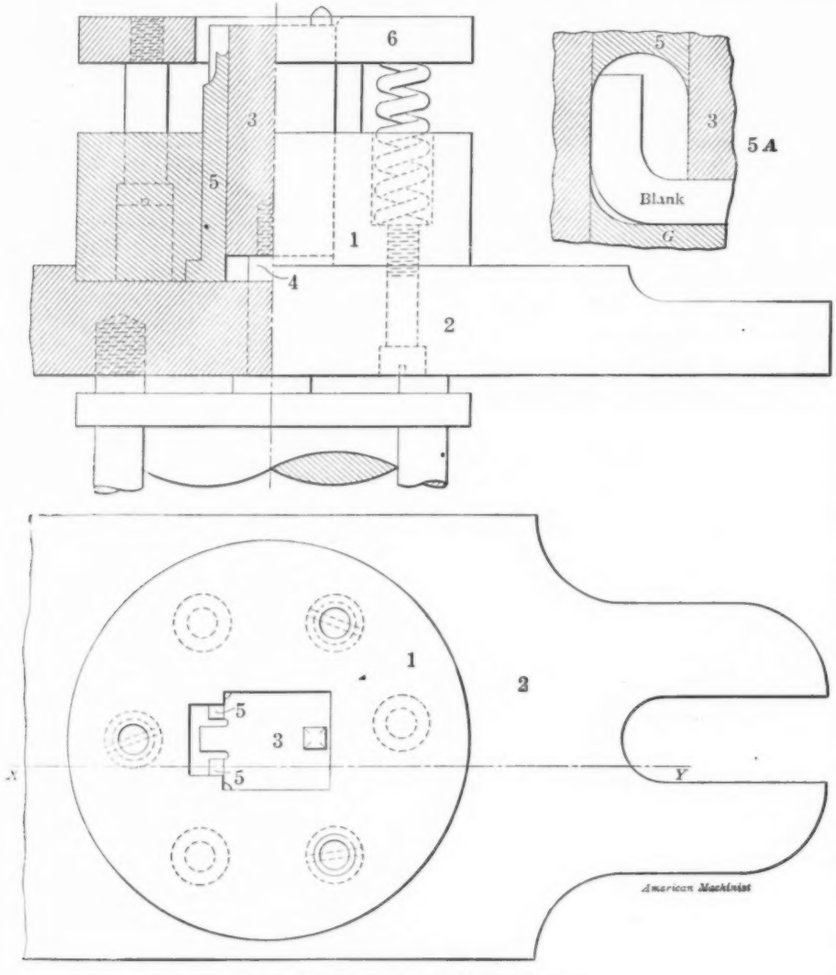


FIG. 5. SWAGING SOLID HINGE BOSSES

It was found impossible to form bosses to over twice the thickness of the material in one forming operation, as the larger space required allowed the metal to simply roll over, giving a rolled boss. But it will swage a double-thickness boss, care being taken that the stock used is of proper thickness, as a difference of 0.002 inch either way made a change in the results gotten from the forming tool.

London, England. H. HARRIS.

A Simple Trimming Die

A simple, cheap and efficient construction for dies for trimming pressed pieces of a shape similar to that shown in Fig. 1 is shown in Fig. 2. The particular case here shown is for outside trimming a lamp back preparatory to "edging" it for assembling.

The drawn piece as it comes from the press has an irregular flange around it. This must be trimmed off to about $\frac{5}{32}$ inch all around, leaving just enough for "edging."

The base of the die is a ring-shaped casting *A* with a flange around its lower edge by which it may be secured to the bolster plate of the press with "toe clamps."

This casting is bored out to receive the hardened tool-steel trimming die ring *B*, which is pressed into *A*. Several holes are provided around *A* for the purpose of inserting a "drift" to knock out the ring *B* if so desired.

A locating and stripping ring *C* of soft steel slides up and down within the casting *A*, being actuated by helical springs within counterbored holes in its lower surfaces and in *A*.

FIG. 1. THE AUTOMOBILE-LAMP BACK

Its travel is limited by shouldered screws *D*, which also prevent the ring from turning. Two notches, as shown at *F*, are cut in the ring *C* to give the operator's fingers a chance to grasp the piece for removal after trimming.

The punch holder *G* is of cast iron and attached to its lower surface is the punch ring *H* of hardened tool steel. This ring is centralized or "piloted" over the circular projecting end of *G*, and knockout holes are provided in *G* to enable the ring to be removed if necessary.

A soft-steel stripper ring *J* encircles the punch *H* and is pressed down by helical springs *L*, as shown in the illustration, its travel being dependent on the shouldered screws *K* in the punch holder *G*.

It is only necessary to drop the part to be trimmed into the ring *C* when the die is separated and to trip the press. These dies are used in any standard press of sufficient length of stroke to enable the piece to be picked out after trimming.

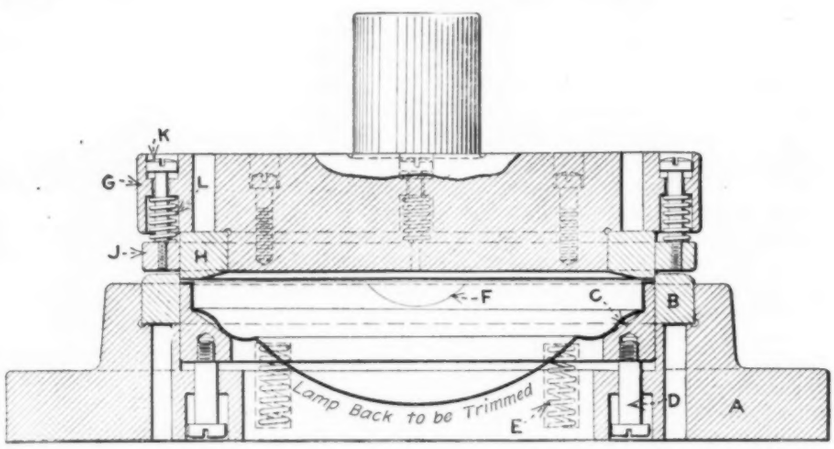


FIG. 2. TRIMMING DIE FOR AUTOMOBILE-LAMP BACK

Detroit, Mich. ARON LAWRENCE.

Large Tenons for Cope Prints and Hubs

Molders sometimes fail to use the rap-hole provided for them, using instead, if small, the central hole intended for the cope core-print or hub.

Fig. 1 shows a way around this difficulty. The cope hub or print, instead of

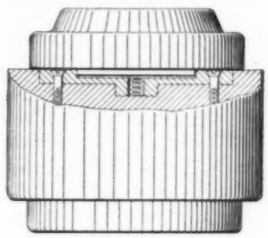


Fig. 1

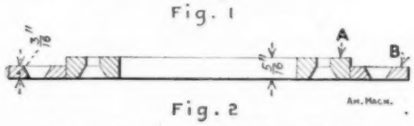


Fig. 2

LARGE TENONS FOR COPE PRINTS

being turned with a small and comparatively long tenon, as is usually done, has a large and short one, so that the recess turned in the main pattern to fit it, is so large and shallow (not over ¼ inch deep) that the molder cannot use it for a rap hole. The regular rap and draw holes are placed inside this recess. In most cases there will be room to "let in" one of the standard malleable rap plates inside the recess; while if the pattern be intended for a standard one, requiring thousands of castings made from it, both the recess and tenon should be made of iron.

Where patterns of this class are frequently required, it is convenient to have a few sets of malleable rings, of several sizes fitted and kept in stock ready for use. The ring *A*, Fig. 2, is about $\frac{5}{16}$ inch thick, while *B* is about $\frac{3}{16}$ inch thick. The ring *A* is turned on the outside and *B* on the inside, an easy sliding fit, while *B* is also roughed off outside, so as to make the outside concentric with the inside. In using these rings, a recess ⅛ inch deep is turned in the parting face of the cope hub, equal in diameter to *A*. The ring *A* is now "let in," and fastened by wood screws. Of course the ring *B* is "let in" the main pattern, flush with the cope surface.

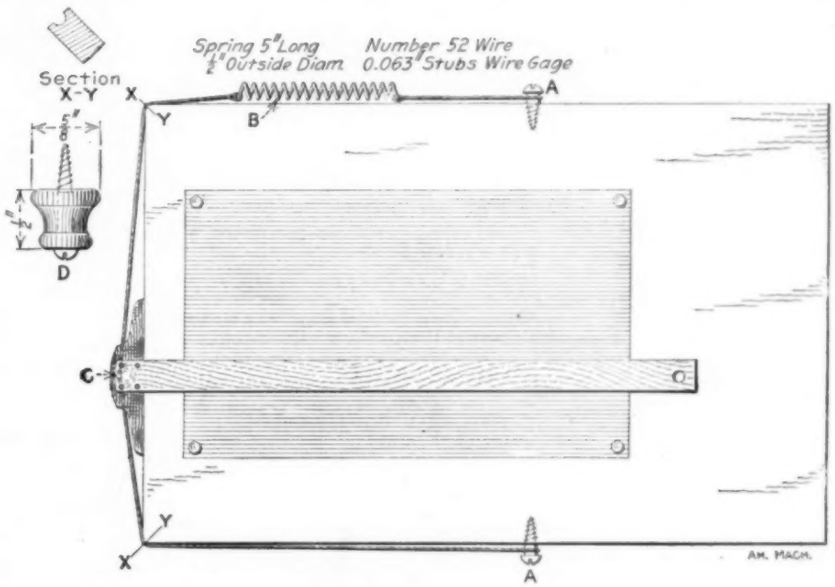
This makes a better way of locating large prints and hubs, than the usual one of using two brass dowels, as the loose part is more easily placed in position by the molder and is also less liable to become tight through shrinkage or swelling of the pattern.

Battle Creek, Mich. T. N. HOFF.

Holder for Drawing Square

Every draftsman has often been annoyed by the necessity of continually holding the T-square against the drawing board when drawing, and most of us know the consequences of spoiled work through forgetting momentarily to do so. As the scheme I have used for a number of years may be new to most knights of the board, I inclose a sketch of it, knowing it to be a cheap and effective way out of this trouble.

The sketch shows the drawing board with attachment. The screws *A* are fastened in the edge of the board, one at the top and one at the bottom near the center. Fastened to each screw is a piece of cord about ⅛ inch diameter, as shown,



HOLDER FOR T-SQUARE

and connected with a spring *B*. The string passes around a wooden roller (shown in detail at *D*), which is attached to the under side of the T-square, shown at *C*. A groove is made at the corners *X* and *Y*.

This holder permits the square to be moved along the board, and it will stay in any position where placed and also will be square against the drawing-board edge, thus permitting both hands to be used in the other drawing operations.

ROBERT MAWSON.

Providence, R. I.

The Grinder in the Shop

The grinder, although a modern invention, has become one of the principal machines in all uptodate shops. Some of us, for various reasons, find it almost impossible to follow the experts entirely in the excellent ideals laid down by them, but a great deal can be done by the shop foreman to make the grinding machine more valuable.

Soon after I came in touch with the machine I realized the advantage of the right wheel for the work in hand, as advised by Mr. Norton and others, but the difficulty I experienced was the time taken in mounting, balancing and truing the wheel after each change. To overcome this, I made a sufficient number of wheel centers to cover our requirements.

Of course, these can be purchased from the makers, which is to be recommended, but many foremen can put one hundred dollars' worth of machine details through their own shop with less trouble and questions than that caused by asking for ten dollars' worth from outside.

I had the grade, grit and shape number of the wheel clearly stamped on each wheel center. This I found necessary, as the tags supplied with the wheels were very liable to get mixed up or lost, no matter how careful we were. On each center we also put a number for shop use.

Our machines, being ranged alongside of the tool room probably assisted me in deciding to hand over the care of all wheels to that department, and so far this has proved a great success. I had a special cupboard made with partitions to receive the wheels, each partition having a corresponding number to the one on the wheel center for location purposes, and a suitable peg is provided for the operator's check. The tool room takes charge of all mounting and balancing of new stones and the rebalancing of each wheel after use, before returning to the cupboard for future use. I have found that having one of the tool-room staff in charge of this is a good method, as although an unskilled man can soon become a fairly good operator, the mounting and balancing of high-speed and expensive wheels calls for the skilled eye and hand.

We record the date of mounting all new wheels, and although we have not thought it necessary to get down to fine points on the performance of each individual wheel, this could be done very

easily by the addition of a record card.

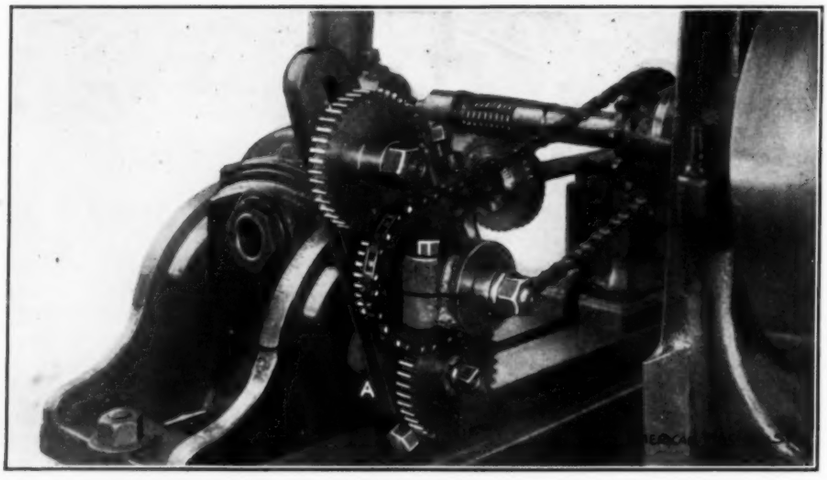
Each operator is supplied with an instruction card, which gives a list of the wheels by the shop number only, and also the particular work they are suitable for, and I have found it much easier for the operator to give me a comparison between No. 7 and No. 9 wheel than it was for him previously when he had to compare a wheel "Grit 46, Grade M" with one "Grit 44, Grade L." Spare centers are also kept for experimenting with any new wheel that comes along, and they at once take equal rank with the rest by having a shop number, which insures them fair treatment and which is easily recognized. Although the first cost of the centers may be considered high, we have found the system to pay and have also a better return from the machines.

Belfast, Ireland. F. P. TERRY

Hobbing Worm Gears on the Miller

The halftone is self-explanatory and shows how some worm gears were hobbed in the shops of the F. L. Schmidt Machine Company, New York City.

The proper gears were mounted on the casting *A*, at the side of the dividing head. The gear to be cut is mounted on an arbor held in the dividing head. The hob is mounted on the miller arbor. The drive is, as shown, by chain from a suitable sprocket on the spindle to another on the casting *A*. This latter sprocket has a gear attached to it meshing with another mounted on the dividing-head worm spindle.



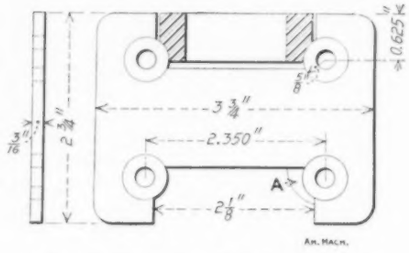
HOBBING WORM GEARS ON THE MILLER

New York. E. A. DIXIE.

Limit Gage for Grinding Ball Race Cones

The object of this writing is to show how an inexpensive and yet an accurate and durable gage may be made for grinding the radius of ball-race cones.

The usual plan of making gages is to lay them out with scribe and dividers and file to the lines. Besides, they must be left soft owing to the liability of warping when hardened; consequently they do not retain their accuracy long.



A LIMIT GAGE FOR GRINDING WHEEL CONES

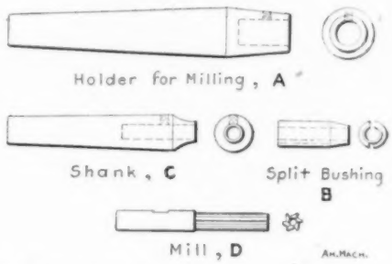
To insure greater accuracy and to make them last longer the gage shown in the sketch was designed. Four hardened and accurately ground buttons the same radius as the cone are pressed into reamed holes which have been previously located by what is known to toolmakers as the button method. After the buttons have been pressed in, the metal which was left at *A* to facilitate the work, is removed from before all four buttons and the gage is then ready for service.

Indianapolis, G. W. LINN.

Combination End Mills and Shanks

In the plant where I am employed they use a large number of small end mills and break a great many. I presume it is the same in other shops. We have an economical and efficient way of replacing them which may interest some of your readers.

The holder *A* is made of machine steel to fit the spiral head of any miller convenient for the job. In our case it is a No. 0 Brown & Sharpe. The holder is fitted with split bushings *B* to accommodate the various sizes. The shanks *C* are then bored out and reamed in a special socket which can be made to fit the spindle of any lathe convenient. In this way the bore is perfectly concentric with the outside. They are then drilled and tapped for a headless setscrew. The mills *D* are made from drill rod cut to



COMBINATION END MILLS AND SHANKS

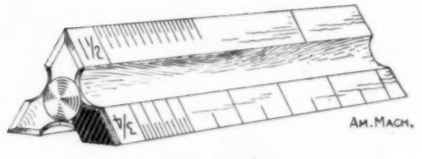
the desired length and centered in a spring chuck. We do this operation in a Rivett precision bench lathe. They are then put in the holder *A* and milled. They are tempered and ground and put into the shank *C*.

We always keep a reserve supply on hand in the tool room. Then it is necessary only to loosen the setscrew, take the broken mill out and insert a new one in the same shank. The setscrew is tightened and you are ready for business.

Pittsburg, Penn. C. C. CROSBY.

Indicator for Triangular Scale

To avoid confusion and save time when using the ordinary triangular drafting scale, make a diamond-shaped pointer out of heavy cardboard, or tin, and fasten it to the end of the scale with a thumb-tack. The pointer should be made the same shape as the triangular end-section of the scale. It may be painted black or red if so desired, to make it more conspicuous.



INDICATOR FOR TRIANGULAR SCALE

To use the indicator, turn the pointer about the thumb-tack until it covers the end of the triangle of the particular scale being used. It will then point directly at the table when the scale is right side up. With the indicator set the draftsman can see at a glance, without studying the fine marking, whether his scale is placed on the paper properly for the particular scale he is working to at the time.

Kenyon, R. I. H. M. NICHOLS.

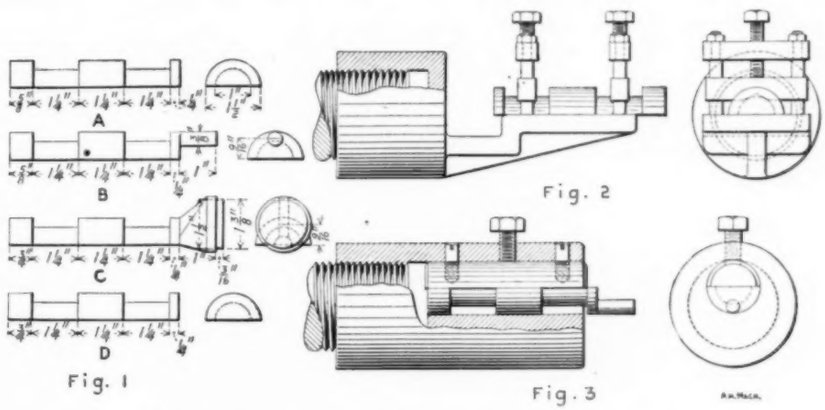
Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

The Engine Lathe as a Manufacturing Tool

Seeing the article under the above head, page 341, I thought it might interest the writer of it and other fellow machinists to learn how I am handling a rather unusual job on an engine lathe.

In a wire-netting machine there are about 150 of each kind of four different styles of half pinions, see Fig. 1, and these must be made very accurate, 0.001 inch only being allowed on the small side. For the first few machines we made, we bought these pinions from an old established firm that made nothing else but these articles. We got a fairly good pinion, but the price was about 96 cents each, much too high, I thought; we therefore decided to make them ourselves.



THE PARTS TO BE MACHINED, THE JIG AND CHUCK

The first method we tried was to turn them from the bar on the turret lathe, making a full pinion for each half required and then milling half of each one away. This lowered the cost somewhat, the total cost now coming to about 72 cents each. We stuck to this method for some time, but I was continually experimenting to find a still better way and, after months of plodding, we are now producing a practically perfect half pinion for about 36 cents each on the engine lathe.

Taking style *A*, I had drop forgings made, leaving about 1/16 inch on for machining. I ground the flat face on a disk grinder, just cleaning it up, and then made a fixture for the miller that would hold six at a time and finished both ends of the forging to the required length by straddle mills.

I then made the jig, Fig. 2, to fit on the nose of a light engine lathe, and clamping a forging on, as shown, I turned one end to exact size, turned the forging round and turned the other end. I took two of the forgings, placed the flat sides together, gripped one end in a spring collet fitted to the nose of the lathe, ran the other end in a revolving chuck in the loose headstock and turned the two necks and middle portion, thus finishing two of these at once. The total time taken for all operations was 12½ minutes for each half piston.

Taking the style *B* half pinion, I had drop forgings made, but instead of having the eccentric pin forged on the end I had that end left semi-circular to the full length of the pin. I finished these forgings by the methods used on style *A*, but after having the teeth cut on the middle part, they were taken back to the lathe and held in the eccentric chuck, shown in Fig. 3, while the pins were turned on end, this operation bringing the time for these half pinions up to 16 minutes each.

Style *C* was rather more difficult on account of the eccentric end projecting over the flat face; hence, I decided to make *C* and *D* together by the following method:

After grinding the face and ending up, I took style *C*, placed it in a jig, Fig. 2, turned the half-round end to size, reversed the forging and drilled a center on the eccentric end. Taking style *D*, I turned the end corresponding with the turned end on *C*, placed *C* and *D* together, gripped the turned ends in a collet, held the other ends of the forgings together with a split collar and ran the center in the eccentric end on an ordinary lathe center. I could then turn one neck and the middle portion. Without taking the pinions from the lathe, I took the split collar off the end of the forgings, put another collar, bored exactly to size, on to the middle portion and turned the remaining neck and end. This finished style *D*, the time taken being 14 minutes. The half pinion *C* was then placed in an eccentric chuck, Fig. 3, and the eccentric end turned on it, the total time for this half being 20 minutes.

I may say that these pinions are a first-class job, and it is very rarely that one comes outside the limit.

Before tackling this job, I had no idea of the possibilities of the engine lathe, all my life previously having been spent among turret lathes and automatics; but one lives and learns.

ERNEST D. O'BRIAN.

Manchester, England.

A Question of Pitches

On page 509, Volume 35, Mr. Groocock, referring to a table of circular pitches for worm wheels sent by me, page 1038, Volume 34, questions the need for using the normal pitch.

From the point of view he takes he is quite right and I must freely admit that some of my observations, which accompanied the table, were written under a misapprehension. I was under the impression that the difference between the normal pitch and the real pitch was the difference between the pitch of the worm and the wheel, whereas, the pitch measured along the center line of the worm axis and the circular pitch of the wheel are alike and if the only consideration is to obtain the diameter of the worm wheel, no other factor need be considered.

In cases where the helix angle is small no further trouble need be taken. It is simply a question of how far it is advisable to go in ignoring the difference which exists between the normal pitch and the circular pitch. Where the worm is to be cut in an ordinary lathe, the difference might not be noticed, even with a fairly large angle, as a thin tool is used and the thread simply cut with space and thread of equal width on the pitch line; but the wheel teeth would call for a thinner cutter than a spur wheel of the same circular pitch or the teeth

would be thinned in proportion to the angle. However, worms are not now usually cut upon the lathe, but upon a thread miller, and the thickness of cutters becomes a matter of importance.

To make this clear, let us take a case such as very commonly happens. A draftsman will issue instructions for a worm and wheel, as follows:

Worm: 3-inch diameter, 1-inch pitch, single thread.

Wheel: 40 teeth, 1-inch pitch.

He bases the diameter of the wheel upon the circular pitch. Supposing the wheel is not to be hobbed but cut spirally with a 1-inch pitch cutter and the worm to be cut on a thread miller, also with a 1-inch pitch cutter. The normal pitch is only 0.9944; there is a difference, therefore, between tooth and space of 0.0056 inch, perhaps no great matter. But now suppose the particulars sent out are:

Worm: 3-inch diameter, 1-inch pitch, quadruple thread.

Wheel: 40 teeth, 1-inch pitch.

As before, the wheel diameter is calculated from the 1-inch circular pitch and the worm cut with a 1-inch pitch cutter, but the helix angle has increased from about 6 degrees to about 23 degrees. The normal pitch has decreased to 0.9205, a difference between tooth and space of 0.0795, more than $\frac{1}{16}$, which, of course, would scrap the wheels.

It can be seen from this how necessary it is, if the circular pitch is to be used, that the normal pitch also be figured out in order to know the proper thickness of cutter to use. This means that a number of cutters would be required to suit different angles, whereas if the calculation be based upon the normal pitch in the first instance, but one would be needed. From the foregoing it will be seen that in using the table referred to, it will be necessary not only to use it for calculating the diameter of the wheel, but also for the worm. This means that the real pitch of the wheel is also the lead of spiral of the worm multiplied by the number of starts, but perhaps it is better in all worm or spiral gears over 10 degrees helix angle to calculate for both worm and wheel, as though they were a pair of spiral wheels. There is no more convenient way of doing this than to take the angles as the starting point, obtaining the real pitch of both through the cosine and the lead from the tangent and circumference.

WILLIAM HAUGHTON.

Birmingham, England.

Method of Filing Drawings

The accompanying figures show a method of filing blueprints. As will be seen, it is very similar to the method described by R. B. Dale, on page 543.

In our case the drawings were all of one size, 24x36 inches, and were grouped according to contracts.

The drawings for one contract were held together, as shown in Fig. 1, by maple strips; the strips extending beyond the drawings about 3 inches. The drawings were held between the strips by $\frac{1}{8}$-inch round-head screws with nuts.

FIG. 1. FIG. 2.

METHOD OF FILING DRAWINGS

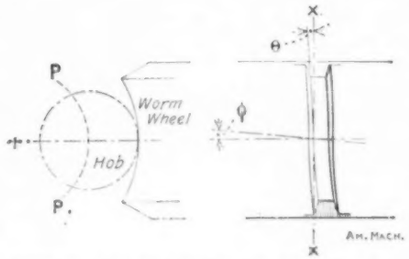
Fig. 2 shows the wooden rack for holding the drawings. The different "books" were kept separated by round, wooden pegs, which were driven along the top of the rack. The drawings hung down between the sides of the rack, being supported by the ends of the maple strips that projected beyond the sides of the drawings.

As the drawings had to be referred to very frequently, the method was very handy.

ARTHUR N. PATTERSON.

Hobbing a Large Worm Gear with a Small Hob

There is no more interesting operation in the machine shop than that of hobbing gears; whether worm gears, spiral gears, or just plain spur gears; and the many ideas that are expressed in the volumes of the AMERICAN MACHINIST on these points, clearly indicate the wide interest that is taken in this matter.



HOBBING LARGE WORM GEARS WITH A SMALL HOB

In all shops, especially in those that do repair jobs, many dodges have to be adopted to make existing tools meet some special case. On page 507, M. A. Hoffman told us how he made a small worm hob cut a wormwheel that had to gear with a worm of much larger radius than that of the generating hob.

The case quoted—or suggested—by Mr. Hoffman was cutting a wormwheel that had to gear with a worm approximately 8 inches diameter, and using a hob of $3\frac{1}{8}$ inches diameter to cut it with. The method he used was that of following a templet so as to get the desired radius. The case he quoted is shown, drawn to scale, on the left of the accompanying cut, and *P* is the path taken by the center of the hob.

Now there are certain fundamental reasons why this could not possibly give good results. Suppose for instance the dimensions quoted were pitch-line diameters and that the pitch of the hob was one inch. Then the angle of the tooth on the wormwheel—see θ in the cut—would be approximately, 2 degrees 20 minutes and the thread angle of the hob would be approximately 5 degrees 50 minutes.

This means that the hob must lie across, or off center, by an amount, ϕ equal to the difference between angle of worm and angle of hob. By doing this we are shortening the pitch, but as this only means, in the case taken, about 0.002 inch, we may ignore it. The fatal objection to the scheme comes when we consider that in raising or lowering the hob to follow the outline of the templet the hob must take a vertical course, that is, it would follow the line marked *X-X*, and the consequence of this would be excessive thinning of the teeth on the outside of the wormwheel.

The width of a wormwheel to gear with a worm 8 inches pitch diameter, would be at least 4 inches (see "AMERICAN MACHINIST Gear Book," page 160) and possibly more, and since the angle of our assumed worm is 2 degrees 30 minutes or approximately 1 in 25, it follows that traversing the small hob from center to side of wormwheel, assuming the distance as only two inches, we shall thin the teeth at the side 0.08 inch. Independent of this thinning, owing to the relatively larger angle of the generating hob, there will be considerable interference at the sides owing to the warping of the thread planes. Altogether the thinning of the teeth would be abnormal and one would get better results from a fly cutter in such cases.

WALTER G. GROOCOCK.

Plumstead, England.

Intelligent Design—A Criticism

I wish to criticize the editorial appearing on page 902, entitled, "Wanted—Intelligent Design" as being too severe on the designer. I will admit that there are many poorly designed machines, also that there are many incompetent designers. But the editorial in question is an unfair arraignment of designers as a whole, and some of the illustrations cited as examples of poor design may, under certain circumstances, be entirely good design and perfectly in accord with standard engineering practice. Furthermore, it often happens that a good designer is forced to work under such conditions, or is so hedged in by restrictions imposed by the management, that the production of a good design is imposible.

How many designers enjoy trying to patch up an old machine to bring it up to date? Not many, I am sure. They know that the result will be unsatisfactory and will reflect no credit upon them, yet the management insists upon the patching process. Is the designer to be blamed for the result?

About the strength of materials. You cannot compare a piece of machinery to a bridge or a truss. In the usual type of such a structure the designer has to deal only with tensile and compressive stresses, the intensities of which are easily determined. And he is using steel whose strength and uniformity can be depended upon. In a complicated piece of machinery the stresses become so complex, and one has to make so many assumptions as a basis of figuring, that the result is little better than guesswork. Besides, the actual strength of the pieces plays but a small part in the design of the modern high-speed machine. It is the question of stiffness that is of paramount importance. This is still more difficult to figure. Furthermore, one is to a large extent dealing with cast iron, a material so unreliable that the structural man will not use it at all. For these reasons the proper proportioning of parts is largely a matter of judgment based upon experience.

An Example

Let me cite an example that came to my notice only a few days ago. A firm purchased a special-purpose machine. It was rather complicated; the loads were severe, uncertain in amount, and suddenly applied. The machine weighed 4000 pounds and cost $2000. Rather a stiff price! This machine was severely criticized by the firm's engineer on several points, the main one being that it was too light for the work. It gave but little trouble through breakage but at the end of four years was ready for the scrap pile. Its failure was not a question of strength, the parts did not break, but the deflection was so great that there was excessive wear on all moving members. In the meantime the makers had increased the weight of these machines to 7000 pounds each.

When negotiations were opened for the purchase of a new one the engineer made them this proposition: "We will buy your machine if you will double its weight." "But we have already doubled it," was the reply. "Then double it again," was the order. They raised a storm of protest, but the engineer was firm and they finally agreed. This increase was made, not by adding pig iron at some one point but by proportionately increasing the size of all the parts. This machine has now been in operation for two years and from present indications is good for ten more, notwithstanding the fact that the speed has been increased 75 per cent. Which was the most *inteiligent* design? The first, no doubt, was based upon computations, the second upon some experience, the last upon more. (It may be of interest to note that the makers are at present putting out all of their machines of the heaviest type.)

I do not wish to convey the impression that I consider computations of no value; on the contrary they are of great value and should be made whenever possible. In many cases the amount and direction of the stresses can be determined with a high degree of accuracy. If the allowable deflection can be determined the parts can be designed as safely and economically as framed structures, provided we use a high enough factor of safety to cover any probable imperfections in the castings. These cases, however, are the exception rather than the rule.

The Design of Bearings

I quote the following from the editorial in question: "A bearing has been located on a machine, it is found desirable to locate another gear on the shaft and room for it is made by cutting off the bearing. The designer's judgment was that the length of the bearing was right before he cut it off, and it is still his judgment that it is right afterward or he would not cut it off." There are two ways of looking at that point.

First, suppose a machine is sold for quick delivery, requiring the addition of the above-mentioned gear. The only way to get the gear on is to cut off the bearing. There is no time to redesign the machine, and the management would not stand for it if there was. It is a case of "Put that gear on and do it quickly or we will get a man who will." It may not be intelligent design but it is good business policy on the part of the designer to do so.

Second, when a number of bearings are located on the side frame of a machine it is standard practice to make them project an equal distance each side of the center line, if it is possible to do so, for convenience in machining. In this case the designer determines the length of bearing necessary for the heaviest-loaded shaft and makes the others the same length, although they may be much longer than required. This may not be intelligent design, in the sense the term is used, but it is good design. In case the gear in question is to go on one of these shafts whose bearing is longer than necessary, then it is good design to cut off that bearing for the desirability of getting on the gear outweighs the original reason for making the bearing long.

Speaking of bearings in general, what is the correct proportion for a bearing? Kent tells us that in some cases 100 pounds pressure per square inch is all that can be allowed, while in others 9000 pounds has been used successfully. Most manufacturers of shaft hangers make the length of their bearings four times the diameter of the shaft; standard rolling-mill practice is three diameters; standard car journals are about two diameters long, and I have seen heavily loaded shafts in constricted places whose bearings were only one diameter. Yet these all give satisfactory service.

This is only one illustration; there are many other points on which the information at our command is just as indefinite. This surely leaves a wide range in which the designer must rely upon his judgment and experience, and illustrates how fallacious it is to attempt to compare the design of a machine with a bridge or truss where the information at the designer's command is definite and generally accepted.

Another point not often considered is, the conditions under which a machine is produced are not always conducive to good design. One instance in my own experience will serve to illustrate this. A machine was sold for two weeks delivery under a penalty contract. The conditions under which this machine was to operate were such as to necessitate an entirely new design. There was no time to make drawings, much less to give attention to the fine points of design. A general layout was hastily made and the entire machine built from freehand pencil sketches. The drawings were completed about three weeks after the machine was shipped.

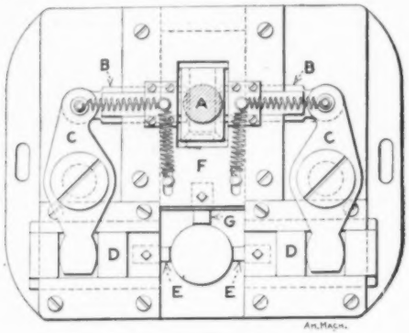
A designer working under such conditions is perfectly justified in using empirical formulas for shaft hangers, or any other part, and his ability ought not to be judged by the machine produced. He should rather be congratulated if the machine goes together and works at all.

There may come a time when machine design will be reduced as nearly to an exact science as structural-steel work now is, but I am afraid that time is a long way off. In the meantime we will have to do our best in an effort to produce intelligent designs.

Moline, Ill. H. J. Mastenbrook.

A Safe Die

Referring to an article on page 580, by W. R. Humelbaugh, on the "Elimination of Dangerous Dies," I show herewith a cut of a die designed and used by us. It



A SAFE DIE

has, as the sketch shows, three punches, all operated by one cam piece, which can be placed at the back of the die away from the operator.

The action of the tools is practically self-evident, the three slides being operated by a cam punch at *A*, which pushes out the two slides *B*, rocking the two levers *C* and pushing in the slides *D*, each carrying a punch in the end at *E*, at the same time slide *F* carrying a punch at *G*, is pushed straight in. Suitable springs draw the slides back as the cam rises.

Waterbury, Conn. M. L. M.

Repair of Plant

The above title has been written under many times. Some writers have appeared to be quite familiar with the subject, while others seemed "quite at sea"—obviously from want of experience. Your contributor, W. George, of London, does not seem quite at home when he says that "one of the worst features in large establishments is the lack of organization" (in reference to repairs), and follows by a lament that in general, records are not kept of the number and extent of repairs required to be done to any particular machine in a large establishment. I do not believe we British mechanics should have this thrown at our heads without reply; and though our countryman, Mr. George (see page 512), has rather thoughtlessly, I think, made it appear that we are negligent in advocating costs for repairs to machines, I am afraid he is writing from an experience which is narrow and closely circumscribed.

For many years I have been familiar with the working of repair systems in many large concerns in England, and the result of that experience goes to show that managers are quite alive to the need of keeping track of the cost for the upkeep of the respective machines, and in large factories here, the system is even carried to an absurd limit in some cases. A machine breaks down and requires to be repaired at once; or if not done at once the hands who use the machine are sent home. But the order of the manager is that for every breakdown or alteration a manager's order must be put through, and the order specifies within close limits the extent of the repair. Time is booked against the order number and the order slip fairly describes the job.

Every machine has a number, so what more does one require for the calculation of the cost for the up-keep of any machine for any specified time?

Engineers are not careless in this respect but most careful, and whether it is a large or small machine in a factory or in an engineering works valuable and necessary systems are in vogue, so that the cost of up-keep of any machine can always be known. I admit the need spoken of by Mr. George, of London, but in fairness to ourselves, I must as honestly say that the need is, generally, supplied.

London, England. J. T. T.

A Crank Pin Turning Fixture

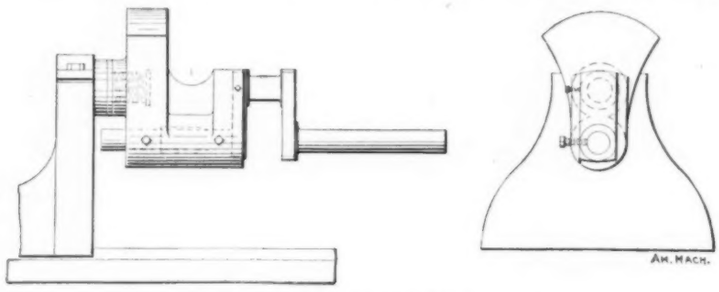
The AMERICAN MACHINIST has recently given a number of interesting articles on gas-engine construction. Among these, one by F. A. Stanley, on the methods employed by the C. A. Stickney Company, St. Paul, Minn., especially drew my attention. In his article Mr. Stanley illustrates a crank-shaft fixture on page 674, used by this company which no doubt on larger crank shafts is a very serviceable fixture; but on smaller cranks, as ordinarily used in gas engines, it has several disadvantages.

The fixture must be very accurately centered and unless some special provision is made for accomplishing this, it requires considerable time and care. Rigidity is one of the first considerations, but with the joint between the faceplate and the flange of the fixture it cannot be fully attained, nor can rigidity be obtained by the cylindrical rest alone for if it could the friction would be excessive. Finally, the position of the cylindrical rest makes the work rather inaccessible and an unobstructed access to the work is very essential for rapid work.

All these points are easily overcome. The accompanying cut shows a fixture attached directly to the spindle nose which is quickly placed in position, and is very rigid. The crank pin need not be much overhung, since the shaft end may pass through toward the headstock.

This fixture has been used to good advantage in one of the large factories. The roughing was done with a set of right- and left-hand tools and then a water cut was taken with a similar set of tools which were ground to provide the proper fillet. No filing was necessary and the pin was as smooth and true as could be desired.

Ottumwa, Iowa. N. LEERBERG.



CRANK-PIN TURNING FIXTURE

The Elimination of Dangerous Dies

On page 580, Volume 35, W. R. Humelbaugh gives various examples of redesigned dies for the prevention of accidents, but he has overlooked several points which I think are also danger spots.

In Fig. 2, is it not possible for the operator to get his fingers damaged by accidentally getting them under the guide pins or cams which Mr. Humelbaugh shows on the sides of the dies in his sketches?

The same thing applies in the case of Fig. 7.

In Fig. 5 it is quite as easy for the operator to get his fingers caught under the die itself, as it is to get them under the flange.

I take it that the die in Fig. 6 is for perforating sheet stock and I, therefore, offer a few suggestions which I think will help to eliminate all these defects. In the case of Fig. 2, why not lengthen the guide pins or cams so that they will not leave the die when the punch is up at its highest point? Fix a sheet-steel guard around the arbor or die, shown in Fig. 4, so that it is impossible for the operator to put his fingers in the track of the slotting punch. With the type of die shown in Fig. 5, I think an inclined press with a chute feed and a spring ejector would be more suitable.

In Figs. 6 and 7 place a fixed guard in front of the dies, giving enough room for the stock to pass through.

Mechanically operated guards are usually finger traps and, therefore, should

be avoided wherever possible. A press fitted with a hand starting apparatus should be used when operating such dies as shown in W. R. Humelbaugh's article, whereby the operator's hands are bound to be away from the dies before the press is put in motion.

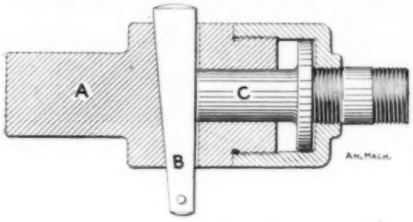
In dies where guide pins are used such as shown in Fig. 6, the guide pins should be made longer so that there would be no space between the top of the guide pins and the punch bolster.

Safety clutches should also be fixed to the press.

Swansea, So. Wales. A. WHITBY.

Nipple Holder

On page 745 Charles Markel describes an interesting pipe nipple holder, which, at first glance, would appear to be about as simple as it is practical; but if, as he suggests, we were to make a full set of this style ranging, say, from ⅛ to 2 inches, we would, it is believed,



NIPPLE HOLDER

find them costing more than the style described below.

In the cut *A* is the nipple holder body threaded to a shoulder to receive various sizes of nipple holders, and also slotted and reamed for the wedge *B* and the plunger *C*, respectively. The end of the body *A* is turned down to facilitate chucking when the pipe machine is used.

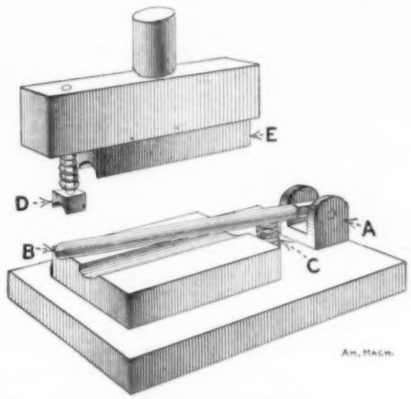
In operation, the wedge B is first driven home, thereby forcing plunger *C* against the inner face of the nipple holder; the nipple is then screwed into place and the thread cut. To release, the wedge is loosened by a light blow, thus taking the pressure off the plunger, when the nipple can be easily removed by hand.

Detroit, Mich. HARLEN P. SNOW.

A Forming Die

On page 605 Mr. Harris shows a very good design of die for producing thin sheet-brass tubing in one operation instead of two, but it appears to me that the withdrawing of the mandrel allowing the formed tube to fall off into the bottom block and then having to remove it from the block, afterward replacing the mandrel again, would be rather a slow method of production. Then again, the two front pillars and springs, being fixed to the die, would certainly retard the operator when placing the blanks on the die block, so I offer a suggestion which would overcome these difficulties.

In the line cut it will be seen that there is a hinge *A* on one end of mandrel *B*, as shown. A small spring



A TUBE-FORMING DIE

C is inserted between the mandrel and the die block to lift the mandrel from the die. A single spring-actuated plunger *D* is attached to the punch block so that as the punch descends, it engages the front part of the mandrel and forms the blank into a U-shape, the spring is then compressed, the plunger moving up into the punch block, and the punch *E* completes the rounding operation.

It will readily be seen that in this method of construction the die has an open front with nothing to retard the feeding of the blanks, and when the tube has been formed, all that is necessary for the operator to do is to draw the tube off the mandrel.

A. WHITBY.

Swansea, South Wales.

Drafting Room Slips

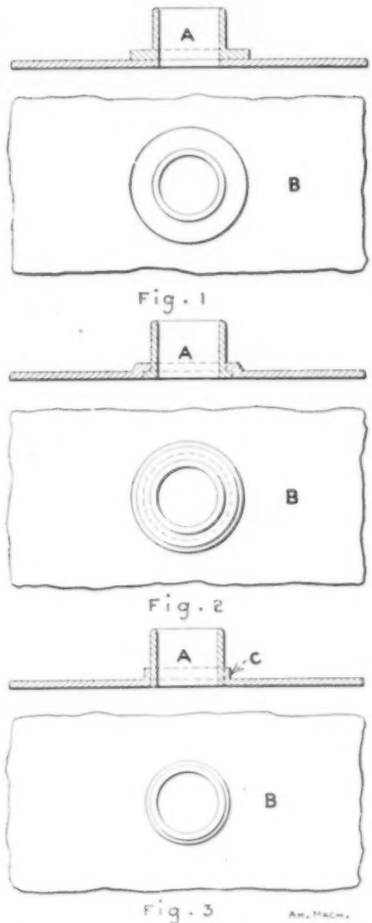
Some notes under the above heading in the editorial columns a short while since struck the writer as being practicable and to the point. The point was made that a draftsman, more perhaps than any other unit of the staff, should be endeavoring constantly to widen his outlook and should try to see the creation of his brain in process of manufacture in every one of the various departments.

Mentally, he must put himself in the place of the molder, the smith, the machinist and all the other units that comprise the shop force. Literally, of course, this cannot be done, but at least he can cultivate the heads of the various departments, talk to them, draw them out, and pick their brains as it were. In doing this he will be helping them, as many men do not realize how much they know of anything till someone discusses the subject with them.

Discussion, too, helps a man to be sure of himself as well as of his subject. Much valuable time and material might be saved if only the draftsman would confer with the heads of the departments, if he would but recognize that of necessity they are bound to be in possession of much knowledge of vital importance to the firm.

Also, he should look upon those heads as being integral parts, with himself, of the same industrial machine and not as so many draftsman do, look upon them as being of a different race altogether.

It should be part of every draftsman's business to keep himself in close touch



THE BUSH AND ITS TIN-PLATE COMPONENT

with those of the shop force, who will be responsible for the production in the concrete form of that which he himself produces in the abstract. That draftsman will make good the soonest, who sets himself earnestly and deliberately to know what others know, so far as it bears on the business in hand, and who takes pains to acquaint himself as fully as possible of the limitations of the shop, its plant, and its force, as well as its possibilities also.

Take a case, as an illustration, that recently came under my notice. An article had been designed, made up by the experimentalists, tried out, and the orders to produce had been issued to the shops.

When the parts arrived at the assembly shop, among them was found a brass bush, or flanged sleeve, to be assembled in alinement with a hole pierced in a tin-plate component. It was to be attached by its flange end, being first tinned, and held in position, and the two members sweated together. Some little trouble was experienced in getting the correct alinement. This was overcome, eventually, by the use of a plug of aluminum, this preventing the solder running into the hole and thereby obviating the use of a reamer.

All this trouble might have been prevented if the draftsman had consulted the heads of the department before the orders to produce were issued. Upon completion of the tests, they should have been invited to inspect the models and offer any suggestions or criticisms, which bore upon the parts they would have to produce.

The job in question is shown in Fig. 1, where *A* is the flanged bush and *B* the tinplate component. Tools had been made and quantities of bushes had been produced when it was abandoned as not being satisfactory, the sweating on not being secure enough to withstand the duty. The assembly room foreman then submitted the two alternatives, sketched in Figs. 2 and 3; Fig. 3 was finally adopted. Comparing Fig. 3 with Fig. 1, it will be seen that the bush is plain, having no flange; this was produced on the automatic from a brass tube of the required diameter at a little over twice the rate of the original bush. Its outer diameter was $\frac{1}{16}$-inch as against the $\frac{13}{16}$-inch diameter of the solid bar from which the first bushes were made. The tinplate component was pierced and drawn as shown, in the same time as it took to pierce the original plain hole. The hole was drawn 0.005 inch less than the diameter of the bush, which was then assembled in the press. This made a substantial job and as a further precaution, solder was run around the bush and the drawn collar at *C*. Thus a better job was produced, successful in every way, at about one-half the cost of the original design.

Fig. 2 would, without a doubt, have been equally successful, but the bush would still have called for a solid bar, so that the cost would still have been high.

The draftsman must recognize that loyal coöperation between the heads of the various departments is a vital factor in the success of the firm. His own success means theirs too, and very often a short consultation may make a great difference between comfortable working of the shop force and sweating to produce within the estimates; in fact, it may even make the difference between profit and loss.

GEORGE WM. SMITH.

Birmingham, England.

Factory Development and Arrangment

"Factory Development and Arrangement," by Mr. Burlingame, page 802, was a very interesting paper, but it was not as thorough as I hoped it would be when I began to read it.

Mr. Burlingame used the Brown & Sharpe Manufacturing Company's methods to illustrate what he called the "Group Department Plan." To anyone at all familiar with the Brown & Sharpe product it is obvious that this plan lends itself particularly well to their purpose. As Brown & Sharpe manufacture such a great variety of machines, ranging from high-duty millers to sewing machines, one can hardly conceive of their handling the work in any other way. But then, according to Mr. Burlingame, the Brown & Sharpe company does not strictly follow this system, and I am unable to see how any firm can use that plan in the strictest sense of the word, for exactly the same reasons that the company referred to cannot. So where is one to draw the line and say just what work is to be completed in one department?

With a factory arranged according to the "Group Department Plan," it is necessary to have a foreman who is an expert on each kind of work, as miller work, lathe work, grinding, bench work and assembling. Such men may be easy to find in the eastern part of the country, but they are scarce in the Middle-West, and in a few years more such as they will be unheard of, unless we all get busy and develop the brightest boys we can find. Many of the plants that are run on the "Group Department Plan" are so run simply because they grew that way and not because they were so designed. And it seems to me that a plant which has a slow, steady growth will just naturally develop that way as new lines are added to the product.

When an entirely new factory is built, however, we often find that it is laid out on what I shall call the Machine-Department Plan; that is, with all machines of a like nature in a department by themselves. Here we usually find the foremen to be men who have specialized on one or two machines. This scheme works extremely well in an automobile or motor-building shop where not more than two or three "models" of machines or motors are built.

I know of one plant where they use this system in spite of the fact that their buildings are very inconveniently arranged and the work has to be moved in every direction imaginable. But with a modern factory, intelligently laid out, it would seem that the Machine-Department Plan would be the ideal system; for with the operations on the work arranged in their proper sequence, the product can be kept moving constantly and toward the erecting floor or stock room.

Perhaps we may hear from someone else on the same subject, for it is a live topic right now and a very interesting one.

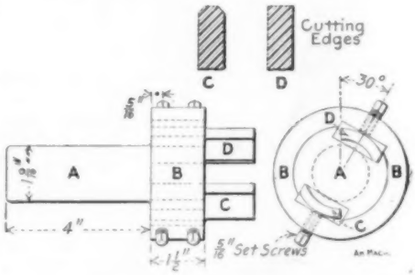
Racine, Wis. LLOYD F. BLUNDEN.

A Cutting Out Tool

There is small room for pride in a reader of the AMERICAN MACHINIST, for how often it is one's experience to find given there a description of a tool similar to one which may have cost them some little time in designing to meet special requirements.

On page 171, Ellis C. Kent describes what he terms a coring cutter, which is similar to one used in cutting out centers for outer and inner ball-bearing rings. The tool I am about to describe is, of course, a much better tool than the one Mr. Kent describes, as it is used for more accurate work. It consists, as shown, of a body *A* an adjustable collar *B* and the blades *C* and *D*, held in place by setscrews.

The body is milled out to the depth of the collar and made a snug fit for the



A CUTTING-OUT TOOL

shanks of the blades, which are rectangular in shape, the back of the milled recess forming an abutment for them.

The collar is also recessed to fit the shank and thus the blades are securely held against any end or side movement, giving them a great rigidity and strength, which is necessary as the stock cut is very tough steel.

The blades are made of Blue Chip steel and the body of tool steel. The cutting surfaces of the blades are roughed out, the body and blades hardened, then the blades are secured in the holder and ground to size.

Blade *C* is ground with corners of the cutting edges beveled so as to take about one-half the width of the cut and blade *D* is ground square to take the full width of cut. Blade *D* is also set about 1/64th inch back of *C*. In other words, *C* takes the first light roughing cut, while *D* follows, taking a finishing cut of full width.

New Britain, Conn. J. M. HENRY.

Cutting a 127-Tooth Gear

By William C. Betz

Mr. Raymond went to an enormous amount of trouble to cut a 127-tooth gear, as described on page 798. If the dividing head he has is a Brown & Sharpe, he could have used the compound indexing method, described by Walter Gribben in the American Machinist of Dec. 12, 1889, which, for 127 spacings, is as follows:

Let the index pin for the 39-hole circle set the sector for 23 holes, make one cut in the blank, turn the index handle two complete revolutions and 23 holes in the 39 circle, remove the pin in the back of the plate and turn the dial in the same direction, counting 12 holes in the 49 circle (which is the outer circle of the plate). Nine complete revolutions of the blank must be made to complete the job. Mr. Gribben gives the following solution:

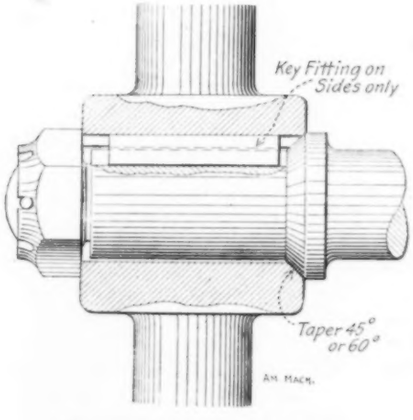
Number of Teeth	Moves	Error of One Diametral Pitch Gear	Times Around
127	$2\frac{23}{39} + \frac{12}{49}$	0.0006	9

William C. Betz.

New Britain, Conn.

Substitute for Long Taper

Your short note on taper fits, page 615, should set draftsmen thinking. Taper fits are expensive to make, especially so



Substitute for Long Taper

where the job is particular as to length.

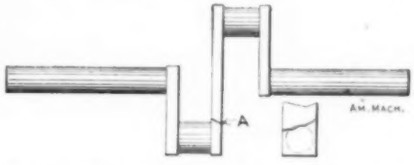
The accompanying cut shows a cheaper form than the usual long taper, which would run true enough for most power-transmission purposes. If an accurate finish to length is required, the taper should be a hardened-steel cone ground true all over, fitting up to a square shoulder on the shaft.

Birmingham, Eng. H. J. Alpe.

Can This Crank Shaft Be Repaired?

I was interested in the crank-shaft repair job described by A. F. Steedman on page 395. This repair, as I understand it, consists of strapping the parts together and not of welding them.

I give herewith a cut of a broken crank shaft from a two-cylinder engine on an auto buggy. The diameter of the shaft is 1¼ inches and the extensions are about 8 inches long. The crank pins are 1⅜ inches in diameter and 1¾ inches long. The crank straps, or webs, are 1¾ inches by ⅞ inch, and the throw is 5 inches. The break, as shown at *A*, is close to one of the pins.



Can This Crank Shaft Be Repaired?

There has been a great deal written about emergency repair work on crank shafts and other things, by welding, brazing, etc.

It used to be that the blacksmith was the only resource, but now there are exploited two or three electric-welding methods, gas flames, thermit, and others, and while all of these can make a fine showing, yet the "breakdown" victim with his dreams of quick repairs at low cost is liable to be disappointed. He finds that there is such a thing as autogenous welding all right, but that all the "ads" fail to mention another important kind, viz., the *ingenious*. In other words, the success of making brazing and welding repairs depends a great deal upon the expertness of the operator, together with the form and service of the broken member.

Thus, when the shaft shown in the cut was broken and the auto stalled seven miles from home, the first thought of the owner was to get the break welded. "They can weld anything nowadays, you know," he said, "and the auto will soon be in service again; also, it will not be necessary to purchase a new shaft for $25." So in his "ready reference book" he looked up the addresses of two or three repair shops in the city 50 miles away, and phoned for information.

"Hello! Is this the Never Fail Welding Company?"

"Yes; what can we do for you?"

"The ⅞x1¾ web of my auto crank shaft has snapped off. Can you repair it?"

"Yes; we do work of this kind every day. Send it up."

"What do you charge?"

"Fifteen dollars."

"Well, I'll see you later; good by."

The price seemed rather steep, but it might be better than paying $25 for a new shaft. However, he called up a second shop.

"Hello! Is this the General Welding and Brazing Company?"

"Yes."

"Can you weld a broken ⅞x1¾ web of an auto shaft?"

"We could braze it, but there will be some distorsion and it must be trued up in a lathe. New bearings will be needed."

"Will it be as strong as a new one?"

"No, not so strong. We cannot guarantee the strength."

"What's your charge?"

"Two and a half!"

Here he got a quotation of one-fifth of that from the first shop, besides learning that a job of this kind might prove unsatisfactory. The next day he took the broken shaft into the city and investigated repair-shop methods. The summary of the whole matter was that the break could not be mended so as to insure strength, alinement and full size of all the parts. A new shaft was the only remedy. Has anyone else had a similar experience?

Scranton, Penn. F. W. Brady.

Indexing Technical Articles

Mr. Wood's scheme for indexing technical articles, page 824, has, let us hope, led many to the fascinating and useful task of making a card catalog.

It is extremely irritating to recall seeing just the desired information somewhere and yet be unable to place the itching finger upon it.

It is a task which requires a few minutes a day rather than a lot of time once a month or so. In this respect it is like keeping a diary, the whole trick lying in not letting it get behind.

Subject-matter indexes are a fine art, and, of course, a very simple form must be used for the busy man who wants efficient results with a minimum expenditure of time. But there is one feature of Mr. Wood's system which, while more in the line of simplicity, seems to make the file less efficient.

In subdividing it is proposed to take the broad class, divide it into smaller classifications and scatter them through the file keeping a single alphabetical sequence. Thus in the case cited, that of machine tools, starting with all forms of tools behind the machine tool guide-card, when it is desired to subdivide, the matter relating to drillers is placed behind a guide-card of that title in the "D's," lathes are in "L," etc. The advantage of having all the machine tools in one place is lost.

The writer finds it better in such a case to use indented subheadings, leaving the machine tools still in one place and getting all the advantages of subdividing.

To illustrate, the headings in this case would be something like this:

Machine tool.
  Boring mill.
  Driller.
  Lathe.
  Miller.

Now if it is desired to further divide any one of these tools they are still kept in the broad class and arranged as follows:

Machine tool.
  Boring mill.
  Driller.
  Lathe.
    Carriage.
    Headstock.
    Tailstock.
  Miller.

This requires a slightly more complicated system of guide and cross-reference cards but the file is much more convenient.

The writer will endeavor in the near future to explain through these columns the system and forms of cards he uses based on the above principle.

Lowell, Mass. IRVING D. KIMBALL.

Elimination of Countershafting

As I was reading about the "Standardization of Machine Tools," page 725, etc., the question came up in my mind: "Why cannot the power required to drive our modern machine tools be transmitted directly from line shaft to machine?"

The designers of our uptodate engine and turret lathes, millers, drillers, etc., dropped the cone-pulley drive and, by putting in the gear box, or all-geared drive, came to the so called "single-pulley drive." A few builders went so far as to put reverse gears into their gear boxes, and by so doing also made their single-pulley drives to one-direction drives. A still fewer number supplied their single pulleys with clutches, so that a direct drive from the shafts to machines is possible.

Some printers' ink has been used lately to tell about waste of power in unalined shafting. I never found it mentioned yet that there was a waste of power in countershafts. But there is a waste and there is friction that can be eliminated.

By eliminating the countershaft we would gain not only the power used for driving it, but the material used in building it.

The working rooms equipped with direct-driven machines would present a less obstructed view. In order to increase the latter, and the operating room around the machine, and decrease danger, the designer would have to place the driving pulley of his machine as high as possible.

Briefly, what I want to suggest is: Elimination of countershafting in machine-tool driving wherever possible, by building the machine tools in a way that allows a transmission direct from line to machine. HANS TH. R. HANITZ.

New Haven, Conn.

Graduating a Metric Scale on an Engine Lathe

With reference to the article "Graduating a Metric Scale on an Engine Lathe," page 505, I do not understand how an 80-tooth wheel on a lead screw 87 millimeters pitch will, if turned 10 teeth, give a pitch of 1 millimeter, and also if turned five teeth give a pitch of 1½ millimeters.

It seems to me that a wheel of 174 teeth is required to be turned one tooth for ½ millimeter pitch and two teeth for 1 millimeter pitch. JAMES FARMER.

Long Eaton, Near Nottingham, Eng.

Milling Side Teeth in Milling Cutters

On page 608, Volume 33, there is worked out a formula for finding the angle at which to set the dividing head of a milling machine when milling the side teeth in milling cutters.

The accompanying table, which was compiled from that formula, is in use every day in the milling-cutter department of the tool room of a large manufacturing concern.

The table shows the angle to the nearest minute, but as an ordinary dividing head is not graduated to read in minutes, the nearest quarter degree is taken.

There is no doubt that such a table will be of interest to toolmakers, and especially to those in charge of milling-cutter work.

Chicago, Ill. HAROLD LAMB.

The Horton Clutch

In the article on the "Theory and Design of the Horton Clutch," by E. H. Fish, on page 546, an interesting mechanism is shown as acting by the balls dropping into place by gravity.

Under this condition all the stress is taken by one, or very few balls, as in the diagram and description; and the mechanism is certain to fail frequently if placed on a vertical spindle.

If small springs are introduced, which keep the balls or rollers in such position that the latter can all take up the drive simultaneously, the clutch is stressed uniformly and the probability of breaking balls much reduced; this produces a very satisfactory and reliable positive clutch, which has no lost motion as with ratchet and pawl devices.

CYRIL H. H. FRANKLIN.

Birmingham, England.

Hand Keyseater

On page 1142, Volume 34, there is published as a recent development a keyseat slotting machine. This machine is my invention and was patented by me October 9, 1883, under number 26,898.

In the meantime I have spread this machine over the whole world. Your article has, therefore, been received by its readers with a peculiar kind of interest. I have had several letters about it. One of the writers says: "That is really the ancient German invention of Weitman," and others to like effect.

It should be to the interest of your paper to correct any wrong impression any readers may have as to the originator of the design of keyseater shown.

Stuttgart, Germany. C. WEITMANN.

Favoring "a Stitch in Time"

There is a time in the year when things quiet down a little and one or two toolmakers are laid off. "There's not much doing," the boss says, overlooking the fact that there are many jobs to be done right there in the tool room.

All lathes that do not bore a straight hole should have their bearings scraped and adjusted, so that they will bore straight; the center should be ground up true.

All lathe tools and others should be gone over and those that are worn down should be dressed up.

Angle plates that are not square should be made square.

Bolts that were nicked up during the rush season should have a die run over them, so that the nuts will go on easily.

There will be lots to do, and when the shop gets busy again the tool room will stand ready for the battle, and then if a job isn't right it can't be blamed on to such and such a machine.

The tool maker feels more like working, as he has good tools to work with.

CHARLES HOMEWOOD.

Waterloo, Iowa.

According to the *American Engineer and Railroad Journal*, there were in use in the United States on December 31, 1910, 54,609 passenger cars, of which 2927, or 5.3 per cent., were of all-steel construction. Besides the latter there were 1481, or 2.7 per cent., built with steel underframes. The rapid growth of the all-steel passenger equipment is best understood when it is known that of the 2000 passenger cars ordered in 1909, about 24 per cent. were of steel construction and 21 per cent. were built with steel underframes, and in 1910 there were 3783 new cars acquired, of which 63 per cent. were all steel and 14 per cent. were of steel underframe construction. At the close of 1908 only four-fifths of one per cent. of all the passenger equipment was of all-steel construction.

Reducing Surface Area for Disk Grinding

By F. N. Gardner*

That it is often possible by the use of a disk grinder to produce parts accurately machine-finished for less than the present cost of the rough castings is a paradox, and I shall attempt to prove its truth. It is obvious that whatever saving there

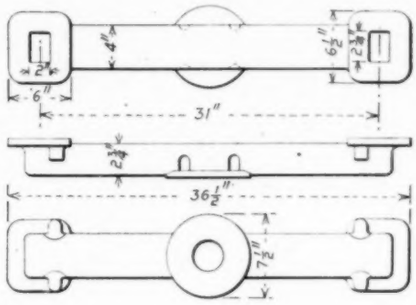


Fig. 1

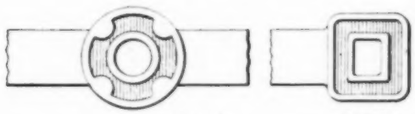


Fig. 2

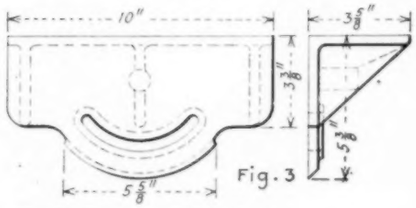


Fig. 3

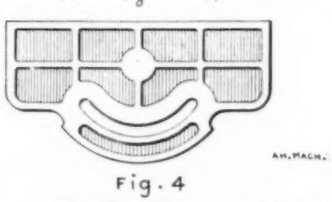


Fig. 4

THE FLANGES TO BE FINISHED

is must be made in the weight of the casting. Castings that are to be finished by disk grinding always can be, usually ought to be, and sometimes must be, considerably lightened before machining them with a disk wheel. First, when patterns are made so as to leave ⅛ inch to ¼ inch of metal for "finish" with a planer, milling machine, lathe, etc., 50 to 90 per cent. of that surplus metal can be saved. Second, flat surfaces that are to be finished by disk grinding can, more frequently than not, have a portion of their area depressed or sunk from ⅛ inch to ⅛ inch or more below the finished level.

Figs. 1 and 2 show views of a piece that has a large flange in the center and smaller flanges at each end, facing the opposite way. It is required to grind these flanges to a finished and true surface. As originally made about ¼ inch in thickness of metal was left on these flanges to be removed by planing. I recommended cutting this down to 3/32 inch, and also depressing the surface about ⅛ inch below the required finish line as shown in black, the black representing the depressed area. By this means the original weight of 55 pounds is reduced to 49½ pounds, showing a saving of about 5½ pounds of cast iron which would mean saving 14 to 15 cents on each casting. And with the area to be ground reduced—by forming the depression shown in black—from 102 square inches to 63 square inches or nearly 40 per cent, these pieces can be disk ground at a cost not to exceed 10 cents each, making the finished piece cost less than did the rough castings as originally made. This was a case where the casting "must be lightened" to make it a disk-grinder job.

Figs. 3 and 4 show a small angle plate. This is not a case where the finished pieces cost less than the ordinary rough casting, because the piece is light and the saving in weight from depressing that part of the surface as shown in black on Fig. 4, although of some account, is quite small as compared to the amount of work to be done. The essential object in lightening this casting is to reduce the area of surface to be ground. Fig. 3 shows the piece as it would ordinarily be made for machining with a shaper or milling machine. Made in this way the large surface has an area of about 38 square inches. I make them as shown in Fig. 4, with 26 square inches of this area depressed ⅛ inch below the finish line, leaving only 12 square inches to be surfaced, which means that by depressing a part of the surface that would otherwise have to be ground, a little cast iron was saved and the amount of grinding was reduced more than three to one. As a matter of fact, it makes the finishing of the surface a cheap and very satisfactory job when to disk grind the entire surface as shown in Fig. 3 would be almost impracticable on account of the

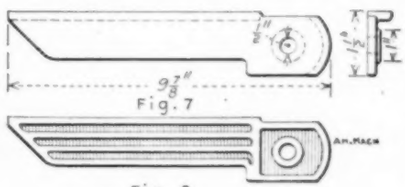


Fig. 7

Fig. 8

A LONG, THIN CASTING

thinness of the casting in proportion to the area of surface to be ground.

Figs. 5 and 6 show another case in which the pattern must be changed if the casting is to be disk ground. The surfaces requiring finish as at present cast have a total area of 155 square inches. If part of this surface is depressed below the finish line, as shown at Fig. 6, this area will be reduced to 90 square inches. The weight of the casting will be reduced about eight pounds, and while that may not quite offset the cost of disk grinding, it will make such grinding practicable and probably cheaper than any other method.

On vertical-spindle disk grinders the work is fed to, or forced against the disk by gravity pressure. When cast iron is being disk-ground it should be forced against the disk with a pressure equaling at least five pounds to the square inch of surface and from that up to 35 or 40 pounds. Any pressure less than five pounds to the square inch makes slow grinding. Now the casting shown in

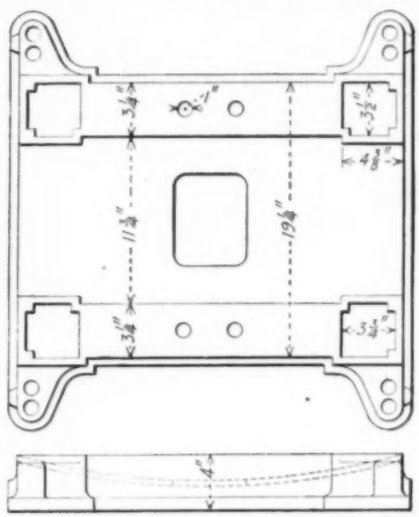


Fig. 5

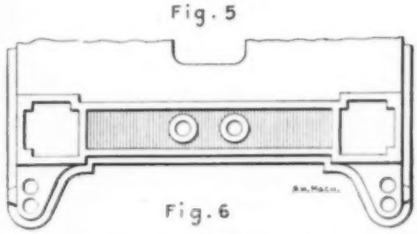


Fig. 6

ANOTHER CASE DEMANDING A CHANGE IN THE PATTERN

Fig. 5 weighs 158 pounds, which gives about one pound per inch. To get fairly good cutting efficiency from the disk, 600 pounds of extra weight would have to be put onto the casting while it was being ground, making a total of over 750 pounds bearing on the disk wheel—which is plenty, if not too much. On the other hand, if this surface area is reduced, as shown in Fig. 6, a total weight of 450 pounds will give quicker and better results.

Figs. 7 and 8 show a casting for a squaring gage used on the plain tables of our disk grinders. The depression shown in the surface in Fig. 8 makes it possible and easy to disk-grind these long thin castings accurately straight and flat. Without the depression the surface to be ground would contain 15 square inches. With the depression it is only

*President, Gardner Machine Company.

eight square inches. Without the depressions the heat generated by grinding would warp the casting and make it difficult to get them straight; with the depressions the heat causes very little trouble and it is easy to get them straight.

I have often said, and it will bear saying again and again, that the place to start profitable and efficient disk grinding practice is in the drafting room. Make your pattern drawings so that the castings to be disk ground will have the least possible stock left for "finish" and the least possible area of surface to grind to a finish. In this way you will save on three important items: The weight of the castings; the cost of finishing them; and on the life of abrasive disks. The extra first cost of making your patterns in this way is so small that it is hardly noticeable and the saving stays with you for the entire life of the pattern.

Annual Meeting of the A. S. M. E.

President E. D. Meier opened the annual meeting of the American Society of Mechanical Engineers in New York City on the evening of December 5 with an address on "The Engineer and the Future." Mr. Meier pointed to the growth of the influence of the engineer and showed that as engineering is the profession of the present, so will it dominate the future. The engineer is responsible for the vast increase in appliances to meet every demand of that most voracious of living beings, man. The mass of mankind needs to be educated to understand and use them properly. He is in honor bound to supply this education; and as the crude dangers and fears of the earlier centuries vanished, so the prejudices and superstitions of the Dark Ages must be swept away.

Technical Sessions, Wednesday

The first professional session was opened Wednesday morning by James Hartness, who read a paper on "The Turret Equatorial Telescope."

A paper, "Expense Burden; Its Incidence and Distribution," was read by Sterling H. Bunnell. Mr. Bunnell maintained that burden items should be analyzed in detail and allocated to the various producing units of the factory, so that the cost of maintaining, operating, and supervising each unit may be known and charged as a time rate against the cost of each item of work passing through the unit. The method of procedure was illustrated in connection with a small machine shop.

H. de B. Parsons suggested that the society promote the question of the use of uniform methods for indicating materials on engineering plans and to this end, supplemented his paper with a sheet of typical standard cross-section designs.

D. S. Jacobus described some tests on two boilers at the plant of the Detroit Edison Company. The rather remarkable efficiency of the boiler and furnace varied from about 80 per cent. at slightly below rating to about 76 per cent. at double rating, on the basis of 10 square feet boiler heating surface per rated horsepower. An animated discussion followed the reading of Mr. Jacobus' paper.

"Strain Measurements of Some Steam Boilers Under Hydrostatic Pressures" was the subject of a paper by James E. Howard.

The principles of herringbone gearing and the accurate production of this type of gears were discussed in a paper by P. C. Day. Mr. Day described several of the applications of these gears, including steam-turbine, hydraulic-turbine, rolling-mill, pump, mine and elevator

Dr. Alex C. Humphreys, Newly Elected President, American Society of Mechanical Engineers

drives, and also a powerful gear-cutting machine, recently perfected for the accurate production of herringbone gears.

The following papers were read during the session on cement manufacture: "The Dust Problem in Portland Cement Plants," "Confirmation of the Advantages of Electricity to the Cement Manufacturer," "Protection of Laborers from Accidents and Injury to Health in Cement Plants," "Methods and Appliances in Cement Plants."

"Geo-Dynamics or the Mechanics of the Formation of Worlds" was the subject of an address delivered Wednesday evening by Dr. R. S. Woodward, president of Carnegie Institution, of Washington, D. C.

Thursday's Papers

H. M. Lane delivered a paper on "The Core Room: Its Equipment and Management," the substance of which has already been published in the American Machinist. The paper dealt with the subject of foundry cores and core-room practice under the following headings: Core-room location and arrangement; core sands and core binders; selection and compounding of core materials; core ovens and core drying; core pasting; core handling and core storage; core machines and core-room rigging. Mr. Lane's object was to show mechanical engineers that it is possible to meet their requirements in the production of castings, but that to accomplish this result core-room practice cannot be based on rule-of-thumb methods; instead, it must approach the precision and certainty to be attained by the introduction of laboratory methods. Mr. Lane gave an interesting, vigorous discussion of a series of lantern slides illustrating his paper.

A brief summary of the state of the art of making small castings in steel molds was given in a paper, entitled "Die Castings," by Amasa Trowbridge. Extracts from Mr. Trowbridge's paper appear elsewhere in this issue of the American Machinist.

George H. Barrus and Charles M. Manly described a variable-speed power-transmitting mechanism, called the "Manly Drive," and a series of efficiency tests on the drive conducted by Mr. Barrus. An actual demonstration of the mechanism was given before the members of the society; an ammeter, a tachometer and a scales, arranged so as to be in plain view of the audience, made it possible for the members to take their own readings and thus calculate for themselves the efficiency of the apparatus. Fundamentally, the "Manly Drive" is a hydraulic device that consists of a pump attached to the driving shaft, one or more fluid-pressure motors on a driven shaft or shafts, the latter being placed in any desired location with reference to the driving shaft, hydraulic connection between the pumps and the motor, and a single operating lever. Changes from one extreme position to the other can be made in the speed of the driven shaft without varying either the speed or the direction of motion of the driving shaft.

"Tests of a Sand Blasting Machine," a paper by William T. Magruder, gave the records and results of quantitative tests of a sand-blasting machine under the actual conditions of commercial practice. Mr. Magruder's paper will be presented in a succeeding issue of the American Machinist.

The following papers were read during the Gas Power session: "Oil Engines," "Test of an 85-horsepower Oil Engine," "Design Constants for Small Gasolene Engines," "1000-kw. Natural-gas Engine; Tests, Construction and Working Costs."

Mr. Ennis, in his paper on design constants for small gas engine, developed a

(*Continued on page* 1144)

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OUTLINE OF TOPICS, PAGE 137

American Machinist

Patents and the Sherman Law

Some anxiety is being felt among manufacturers and corporations whose business is largely based upon patents, because of the recent decision in one case, and settlement in the other, in suits brought by the Government against the Standard Sanitary Manufacturing Company (the so called Bath-tub Trust) and the General Electric Company (the so called Electric-lamp Trust).

Any impressions that may exist that the attorney-general has alleged, that the exercise of a patent monopoly is in violation of the terms of the Sherman act, is incorrect. Nothing of this nature has been done in any of the petitions that have been filed by the Government. The rights of inventors, as specified in any patent or patents, have not been invaded.

What the Government did contend was, in the case of the electric-lamp trust, that after a manufacturer working under a patent had sold the article manufactured, his right to exercise any further control over the product either as regards its use or selling price ceased. In this case the defendant accepted this contention.

In the case pending against certain officials of the United Shoe Machinery Company (the so called Shoe-machinery Trust) the Government takes the position that a consolidation of patents all relating to a single industry is unlawful where such consolidation acts to produce a restraint which would not be possible were such patents in the hands of individual owners.

From this it will be seen that the attack by the Government is not against monopoly created by patents, but against agreements, combinations and the like, based upon the patents and intended to exercise the control in an industry beyond that covered by the patent grant. Or, in other words, the Government takes the position that an inventor may exercise the absolute monopoly given him by his patent, but that neither he nor any combination of persons or interests may use such a patent grant or a combination of patent grants as a basis for exercising the monopoly or control in an industry which is in any way beyond the monopoly of the patent grant itself.

A well known patent attorney in New York City summed up the situation by saying that manufacturers in order to keep within the Sherman law, should remember:

1. That they can make no agreement with purchasers, agents or distributors, by reason of which the use or the reselling price of the article is fixed and determined.

2. That no agreement may be made between individual owners of separate patents, or business conducted, by the single owner (be it individual or corporation) of a group of patents in an industry, where the purpose of the agreement or the nature of carrying on the business is such as to obtain an extension of the monopoly created by the patents, or in other words, effect a control or partial control of an industry, and thus unreasonably restrain and hamper the trade of others.

This gives the position of the United States Government today in regard to patents under the Sherman law. Whether or not this position will be finally upheld depends upon the decisions of the United States Supreme Court.

It is evident that there is nothing in this position or decisions thus far given to deter inventors and manufacturers from patenting inventions that they may have in hand. The monopoly given by an individual patent grant has not been and cannot be invaded.

Uncle Sam as a Repair Shop Proprietor

The recently issued annual report of Colonel Goethals, reviewing the work on the Panama canal, contains the following recommendations:

"The revenues of the canal should go to pay not only the operating expenses, but to repay the capital invested. Every legitimate means for increasing the revenue should, therefore, be adopted. The Government should have coal and fuel oil on hand for its own vessels, and these commodities should be sold to shipping using the canal. These should be supplied at an established rate and purchased after advertisement. The existing commissary, manufacturing plant and laundry should be continued for the benefit of Government forces and to furnish supplies and service to shipping. A wireless-telegraph station should be established for commercial as well as military purposes. The canal authorities should be authorized to sell tools and appliances needed by ships, and to make repairs as may be necessary while ships are in the vicinity of the canal. A dry dock should be built with dimensions conforming to the locks."

This proposes to make Uncle Sam a coal dealer and proprietor of a jobbing machine shop, not only to provide fuel and make repairs for his own ships, but to furnish coal, oil and machine-shop work for privately owned vessels.

Water will also be supplied to vessels from the newly established water works at Gatun. This is a three million gallon plant with all modern appliances for securing pure water. It was built primarily for the inhabitants of Gatun and will be found a great convenience to vessels.

Thus the United States Government is to compete directly with certain private enterprises.

This course if pursued will surely excite protest and we have already heard some adverse comments. But much can be said in its favor. We have an enormous investment in the canal, and the operating expenses will be no small item. To be a real success it must pay—pay not only its running expenses but also gradually return its cost.

To make all this a reasonable certainty the Government is justified in taking all proper steps to attract shipping to the canal route. The establishing of a coal depot and providing facilities for docking and repairing vessels are clearly within the scope of such proper steps.

The danger lies in Government-estimated costs. If these are accurately determinated and charged, no private shipyard need fear Government competition at Panama. But if these costs are not properly found, competition will be unfair, and likely as not we shall all be

helping to pay for repairing John Bull's ship, and still further aiding him in controlling the sea transportation of the world.

Costs in our navy yards are none too accurately ascertained. It is stated by persons who should know, that the costs of ships built and repaired in United States navy yards never contain a proper amount for overhead expense. What will be the result if charges for repairing at Panama are below cost?

Properly fixed charges will leave the private yards nothing to fear. Of necessity, wages in the canal zone will always range higher than in the States. It is doubtful if the output per man on machine-shop work there will equal that of the average workman in home shops. These factors alone are sufficient to make the position of the private yards strong when bidding on work that can wait until the ship is in a home port.

This, of course, will throw only emergency work into the Government shops. And this accommodation will aid in attracting shipping to the canal route, the object desired.

To repeat, when Uncle Sam sells coal and repairs ships he must watch out for his costs and charges, else we will be justified in making a vigorous kick.

Money Saving Courtesy

The rush of modern business causes some of us to overlook many little courtesies which would not only make life a bit more livable, but also save many dollars in the course of a year.

A very common case comes to mind where a manufacturer sent an inquiry to a machine-tool builder for information and prices concerning a specific machine which he built. This being the kind of direct inquiries which machine-tool builders know it is advisable to follow up, information concerning it was sent immediately to their representative in this district, so that he might call and the order secured if possible.

It so happened that it was impossible for him to call within a week, and when he did arrive, he was informed that a machine of another make had been ordered.

This is such a common occurrence that neither the agent nor the manufacturer thought very much about it, but a letter announcing the fact that another machine had been bought would have saved the machine-tool builder from whom the inquiry was made, considerable time and expense for his traveler. Of course, it may easily be said that he was not asked to call, and yet a direct inquiry of this kind is considered as being a lead which should be followed up by all modern business methods.

A little forethought in matters of this kind would save considerable expense in the matter of selling machine tools, which would react favorably on the whole industry.

No one who looks into the matter at all deeply can fail to realize that the expense thus entailed is not and cannot be, borne by the makers of the machine being sold, but must be added to the price, so that it is eventually paid for by the customer. A very brief letter and a two-cent stamp could prevent more loss of time and money in this way, than in almost any other that we know of.

New Publications

Railroad Operating Costs. Eighty-two 9x12-inch pages. Published by Suffern & Son, New York. Price $2.

This consists of a series of original studies in operating costs of the leading railroads, and it would be well if all investors in railroad securities made a careful study of the information it contains. For if this were done, pertinent questions would be asked and many self complacent directors and managers would find it difficult to maintain that railroad operation had reached its highest efficiency.

Many extremely interesting facts are brought out as to the increase in size of locomotives and in fuel consumption, while the cost of maintenance and operating expenses vary in a way that is often difficult to explain. Some roads increase while others decrease, some with good reason presumably and others without, but all of vital interest.

Graphic charts, some of them obtained from the statistical office of the Santa Fé, form a considerable section of the book and show at a glance, information that it would take much time to gather from tables. The comparisons made in this way appeal to the eye instantly and make a lasting impression.

The efficiency of railroad shops has improved materially in most cases in the last ten years, but the book in question points out very clearly that low cost of maintenance does not depend on this alone, but on the kind of motive power and rolling stock. It contrasts the Harriman policy of standardizing locomotives and parts with the Santa Fé, where the types of locomotives are constantly increasing and now number over 180.

The number of pages hardly gives an idea of the amount of information contained, as the margins are small and there are a number of inserts showing interesting profiles of the leading railroads.

The many problems of railroad operation discussed in this book show clearly the authors' familiarity with prevailing practices and conditions, and everyone who is interested in the economics of modern railroading should become familiar with the information it contains.

Personals

William H. McIntyre, formerly fourth vice-president Equitable Life Assurance Society, has been elected first vice-president and general manager of Manning, Maxwell & Moore, Inc.

G. S. DeLany, for the past six years manager of the Stevens-Duryea plant at Chicopee Falls, Mass., has become factory manager of the Matheson Automobile Company.

E. W. Burr, until recently with the Westinghouse Machine Company, has been appointed superintendent of production of the Reliance Motor Truck Company, Owosso, Mich.

Charles J. Jackson, manager of the Jackson Vise and Tool Company, Vineland, N. J., has become secretary and general manager of the Easton Tool and Machine Company, Easton, Penn.

Sidney G. Koon, for four years editor of *International Marine Engineering*, and more recently metallurgist with the Jones & Laughlin Steel Company, has joined the staff of Walter B. Snow, Boston, Mass.

G. A. Werkt, who was with the Raritan Copper works, Perth Amboy, in 1906, is requested to communicate with Alonzo G. Collins, 1715 N. Twenty-first street, Philadelphia, Penn., on a matter of importance.

R. Sanford Riley, Providence, R. I., formerly president of the American Ship Windlass Company, has disposed of his interest in that company and organized the Sanford Riley Stoker Company. His new company is to manufacture a new type of stoker.

R. T. Wingo, recently connected with the engineering department of the Cadillac Motor Car Company, and an occasional contributor to our columns, has been appointed assistant general manager, in charge of production, of the Hupp Corporation, Detroit, Mich. Mr. Wingo was previously connected with the Brown & Sharpe Manufacturing Company, in various capacities.

Jason A. Bidwell

Jason A. Bidwell, best known as inventor of a machine for making gimlet-pointed screws, and one of the members of the Union Steel Screw Company, Cleveland, Ohio, died on November 30.

Mr. Bidwell was born in northern New Hampshire and went to Providence, R. I., while a young man, during the time of the Civil war. He began his career as a machinist with the American Screw Company, and it was while working at this plant that he conceived and developed a machine for making perfect gimlet-pointed screws. In the late sixties he went to Cleveland, where he, in partnership with others, founded the Union Steel Screw Company, with which he was connected up to the time of his death.

Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

Machinists' Fine Tools

The accompanying halftones show several machinists' tools recently manufactured by the Brown & Sharpe Manufacturing Company, Providence, R. I.

Fig. 1 shows an improved universal bevel protractor with acute angle attachment. This tool is designed for all classes of work where angles are to be laid out.

One side of the tool is flat and thus the protractor can be laid flat on the work or paper. The graduations on the dial read to degrees throughout the entire circle and the graduated surface is depressed a small amount so that the graduations are protected from wear.

In order that fine measurements may be made, a vernier is furnished which reads to five minutes or $\frac{1}{12}$ of a degree. To still further aid in making the finer measurements, a fine adjustment is provided by means of a small thumb screw. The protractors are furnished in two sizes, one having a 6-inch blade and the other a 12-inch.

Fig. 2 shows a new rolling-mill gage called micrometer caliper No. 69. It is adapted for measuring sheet metal and has a wide range of other uses requiring a caliper with a deep opening. The measuring screw is incased and protected from dirt and injury. Means of adjustment to compensate for wear is also furnished. The opening in the frame is about 3 inches deep. It has a range of 0 inch to 1 inch.

The tool shown in Fig. 3 is a V-block and clamp made particularly for laying out work in connection with the surface plate and knee. These blocks, which are sold only in pairs, are made of tool steel, hardened, with the sides ground parallel to each other and the V-grooves ground central and parallel to the bottom and sides. Each pair of blocks and clamps are numbered, this being done so that the V-grooves in blocks of the same number will be in alinement.

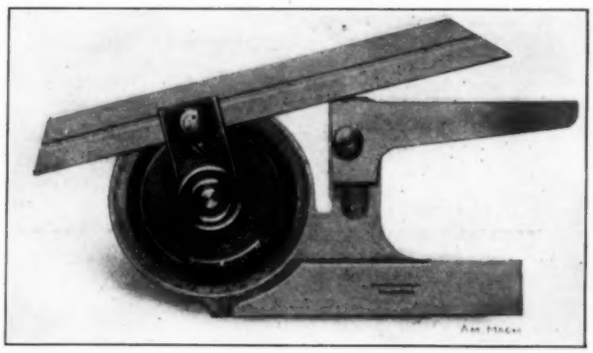


FIG. 1. UNIVERSAL BEVEL PROTRACTOR

FIG. 3. BLOCK AND CLAMP

FIG. 2. ROLLING-MILL GAGE

No Overhung Gear Crane Trolley

The Cleveland Crane and Engineering Company, Wickliffe, Ohio, has recently developed a crane trolley of a simple and compact style. The hoisting mechanism is composed of a cable-winding drum of large diameter, to the outside of which is keyed a heavy gear of wide face and large pitch, into which meshes a brake pinion. This pinion runs on an intermediate shaft, to the opposite end of which is keyed the motor gear, which is a gear of large diameter, and into this gear is meshed a motor pinion, keyed direct to the armature shaft of the motor. The drum is mounted on a heavy forged shaft running in a bronze bearing on the top side of the trolley frame. Bearings for the intermediate shaft are also on the top side of the trolley frame. These bearings are of the capped tongue-and-groove type, the cap being held in place by through bolts.

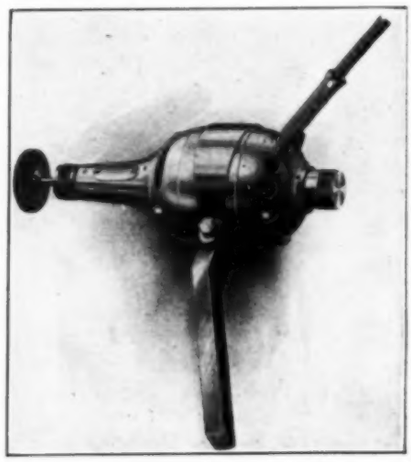
The trolley traverse is accomplished by one long axle extending across the trolley, on which are keyed two driving wheels, one on either side of the trolley.

The two main frames are held together in alinement by a heavy structural tie piece securely riveted to the frame casting.

Portable Electric Grinder

The outer casings of the portable electric grinder shown in the accompanying halftone, are made of aluminum, and the grinder complete weighs 5 pounds. The bearings are dust proof, and adjustable end thrust and bearing take up wear.

The motor is $\frac{1}{6}$ horsepower and oper-



PORTABLE ELECTRIC GRINDER

ates on direct or alternating current. The speed of the wheel is 10,000 revolutions per minute, and the machine is adaptable for both external and internal grinding. Its design enables ready attachment to the various machine tools.

This machine is a recent development of the Hamilton-Beach Manufacturing Company, Racine, Wis.

Facer and Borer

The accompanying halftone shows a type of facer and borer recently placed on the market by the Rochester Boring Machine Company, Rochester, N. Y.

The machine is built for boring and facing combined, or for facing only. The two facing arms, it will be seen, are located in different planes and are of different lengths. The short arm is designed to reach into the casting and face the inside simultaneously with the long arm facing the outside. The surfaces to be machined are not continuous, which means an intermittent cutting. The toolholder is arranged so as to be able to feed at right angle in either direction. The toolholder can also be swiveled to any desired angle, being graduated to degrees indicating amount swiveled.

All gears and running parts are inclosed and fully protected. The worm and worm gear for the drive run in oil. The worm is made of nickel steel and hardened. Starting, stopping and changing of speeds are controlled with one lever located conveniently for the operator. By using a special variable-speed motor and with the combination of mechanical speed changes provided with gearing in the machine a wide range of speeds is possible. The range of the machine illustrated is 8 to 1, the slowest speed being 1½ revolutions per minute, the fastest 12 revolutions per minute. The large arm will face up to 50 inches in diameter; the small up to 30 inches in diameter. The feed for facing is by star wheel.

When the machine is built both for boring and facing, the spindle can be used up to 6 inches in diameter for boring. The spindle has separate bearings in the housing and is driven by spline keys fitted into the sleeve, on which the main driving gear is mounted. Suitable feeds are provided for the spindle for boring. The spindle can also be quickly traversed longitudinally by a large handwheel.

When furnished as standard, the machine has single pulley drive with constant belt speed.

The machine illustrated herewith was designed and built for the General Electric Company, Erie works.

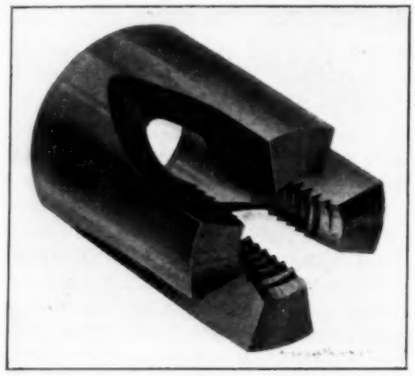
Combination Center Drills in Sets

The J. T. Slocomb Company, Providence, R. I., is putting on the market its combination center drills in sets Heretofore it has been possible to buy these either in a plain box containing a dozen of a size or else singly. The set idea is to provide a center drill to take care of the various sizes of work that might be met in regular everyday shop work.

The drills are put up in a finished wooden box containing one each of the eight sizes of drills regularly listed.

Spring Die

The accompanying halftone shows an improved form of spring die which the



SPRING DIE

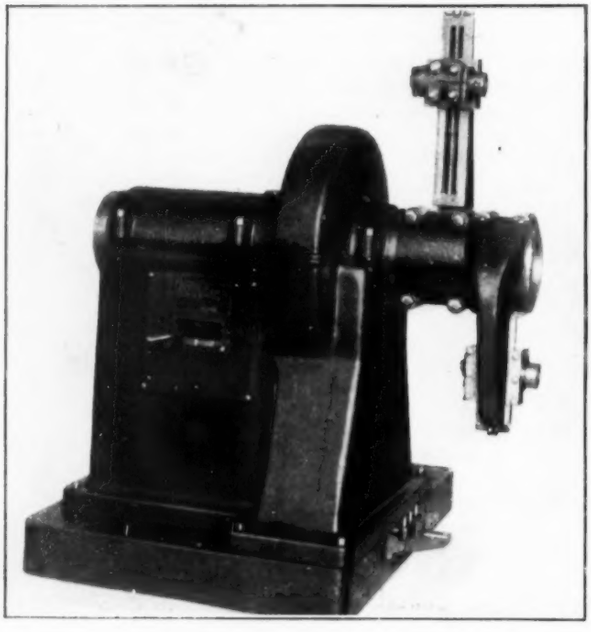
National-Acme Manufacturing Company, Cleveland, Ohio, has recently developed and will manufacture with S. A. E. "V" and U. S. standard threads.

Patternmaker's Disk Grinder

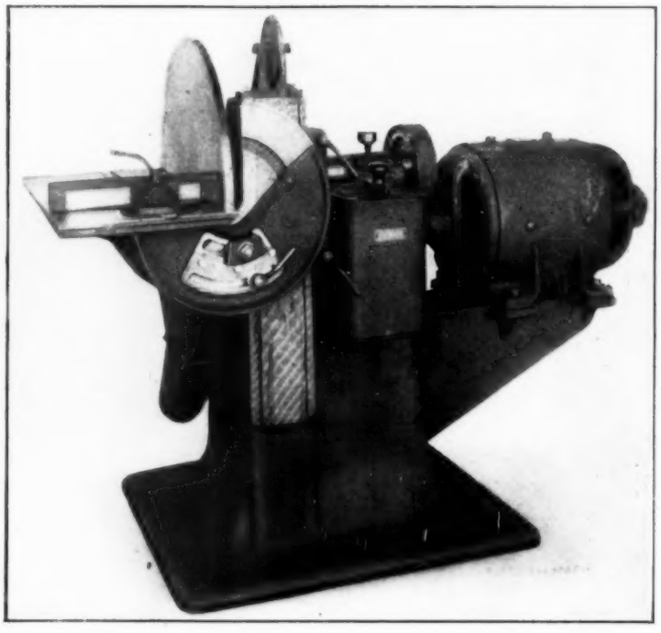
The accompanying halftone shows a motor-driven patternmaker's disk grinder recently developed by the Gardner Machine Company, Beloit, Wis.

The machine is of the single-end type carrying a 30-inch diameter wheel.

As will be noted, the motor is mounted to drive through gears so that the end play of the armature is not transmitted to the wheel. The controller is attached to the front of the machine, and semi-inclosed guards cover the gears.



FACER AND BORER



PATTERNMAKER'S DISK GRINDER

Combination Vertical Miller and Cold Sawing Machine

The accompanying halftone shows a new design of combination vertical miller cold-metal sawing machine, recently built by the Newton Machine Tool Works, Philadelphia, Penn.

COMBINATION VERTICAL MILLER AND COLD SAWING MACHINE

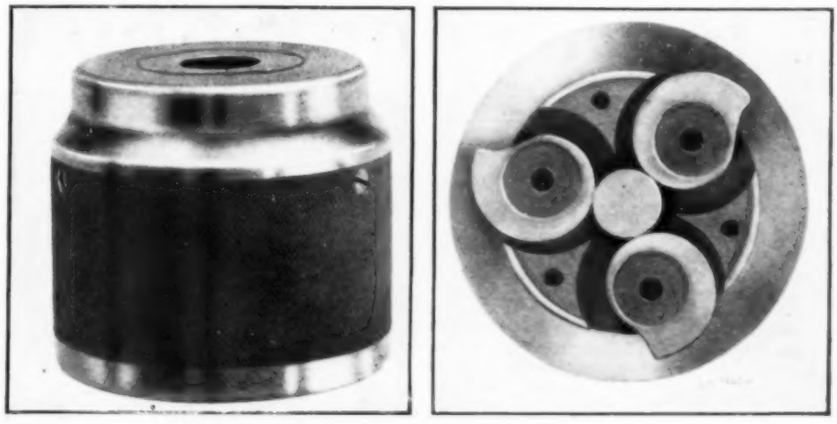
This machine is particularly adapted to cast-steel wheels having central cores to remove, and for removing superfluous stock from small open-end rods, radius bars, eccentric bars, combination links and valve-gear rods.

As a cold-metal saw, 26-inch diameter blades are used having a capacity for 7½-inch rounds in one cut. The machine is arranged for belt or motor drive, has 4 changes of belt speed in addition to 2 to 1 back gears, and 8 changes of reversing speed are available for the circular, cross and in-and-out feeds, in addition to hand adjustments. All transmitting shafts are clutched, clutches having permanent positions and are controlled by levers.

The diameter of the circular table over "T" slots is 36 inches; diameter of circular table over all 41¾ inches; length of cross feed 30 inches; length of in-and-out feed 26 inches; maximum hight under spindle 18 inches; distance from center of spindle to upright 28 inches.

An Automatic Drill Chuck

The halftones show a quick-acting automatic chuck made by the Emrick Drill Chuck Company, 139 Stockholm St., Brooklyn, N. Y. The drill is gripped by three equally spaced cam-shaped jaws. These jaws are geared together through the nurled outer sleeve which controls them. In action the greater the twisting stress on the drill the tighter the jaws grip. The grip of the jaws on the drill-shank can, however, be instantly released while the machine is in motion by holding the nurled sleeve which turns the jaws simultaneously to their widest opening. Heretofore, the range of drill chucks of this type has been limited to the holding of drills of nearly the same size but with the chuck shown, drills from ¼ to 1 inch can be securely held. The smaller size of chuck will take all sizes from ⅛ to ½ inch. The chuck is simple in construction and there are few parts to get out of order; it has the further advantage of being practically self-cleaning. The action of the jaws in closing tends to wipe any chips or dirt which may be on the drill shank or lodged in the working parts of the chuck away from the contact points of the jaws and the drill shank.



A QUICK-ACTING AUTOMATIC DRILL CHUCK

Triple Lever Screwdriver

The design of this screwdriver is apparent from the halftone.

By the arrangement of dividing the handle, and the use of a bolt and thumb nut, spotted on the inside at the joint, the handles are held in any position, allowing a variety of leverages. Both halves of the handle can be adjusted to any desired angle up to 90 degrees. Inaccessible screws are easily reached by adjusting the entire handle.

TRIPLE-LEVER SCREWDRIVER

This screwdriver is a recent product of the H. D. Smith & Co., Plantsville, Conn.

Annual Meeting of the A. S. M. E.

(*Continued from page* 1138)

more general expression for brake horsepower to include the effect of piston-speed variations.

Friday's Topics

The great development of the textile industries has led to a great concentration of engineering skill upon construction, power, machinery and general plant arrangement, and the general efficiency of modern mills is high. There are, however, many unsolved problems and many difficulties, the solution of which seems to depend largely upon the mechanical engineer. Automatic machinery has been developed largely in order to cut down labor cost, but in spite of these changes in machinery, the producing capacity of 100,000 square feet of mill surface has not appreciably increased within the past 40 years. Many machines and many processes cry out for improvements, which have not yet substantially advanced, in spite of many years of experimenting. Maximum possible speed of operation seems to have been reached in most machines, with the exception of the spinning machine. The situation suggests that large increase in producing capacity may have to be sought in the more or less complete abandonment of the traditional methods of manipulating textile fibers. The labor problem is in many cases serious, owing to the poor quality of operatives. Measures were suggested to meet this situation in Frank W. Reynolds' paper, "The Development of the Textile Industries of the United States."

In many industries, such as the manufacture of textiles, food products, high explosives, photographic films, tobacco, etc., regulation of the humidity of the atmosphere is of great importance. "Rational Psychrometic Formulæ," a paper by Willis H. Carrier, dealt with the subject of the artificial regulation of atmospheric moisture, technically known as air conditioning.

A paper, "Air-conditioning Apparatus," defining the principles governing its application and operation, was delivered by Willis H. Carrier and Frank L. Busey.

"Some Experiences with the Pitot Tube on High and Low Air Velocities," by Frank H. Kneeland, related to the use of the Pitot tube for the measurement of flow of large volumes of air.

The Social Features

The social features of the meeting were made especially enjoyable by the genial spirit which pervaded them and drove out the lower temperatures of formality which too often exist. The President's reception was probably better attended than ever before, the same cordial spirit prevailing here as elsewhere.

The ladies were well entertained by a special committee in charge of Mrs. Jesse M. Smith, while the excursions arranged and managed by Prof. Walter Rautenstrauch, were extremely interesting and well attended. These included visits to the steamer "Olympic," to the Edison Phonograph Works, the Brooklyn Navy Yard, and other points of interest.

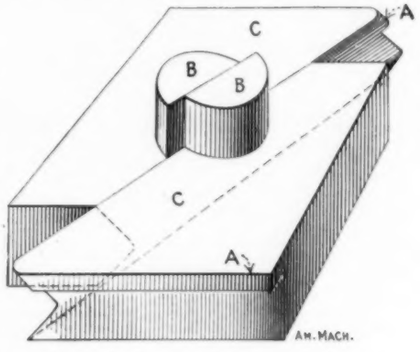
Election of Officers

The officers elected for the ensuing year are as follows: President, Dr. Alexander C. Humphreys; vice-presidents, William F. Durand, Ira N. Hollis and Thomas B. Stearns; managers, C. B. Davidson, Henry Hess and George A. Orrok; treasurer, William H. Wiley.

Bench Vise Jaws for Gripping Internally

By C. Whiteside

The line cut shows vise jaws for gripping work, having a hole in it, internally, by means of the members *B*. The lips *A* rest on top of the jaws of the bench vise, and as the jaws are closed the two members *C* and *D* slide past each other and the work is gripped. Two sizes of grips will take all work from 1 to 4 inches in the hole.



Vise Jaws for Internal Grip

The use of core jigs is not confined to small work, such as cores in connection with automobile castings, but may be applied to steam engines or any large work. A wooden or metal frame may be constructed with bearing points corresponding to the bearing points which carry the cores in the mold. The cores to be tested can be lowered into one of these jigs with the crane and then by means of suitable gages, the metal thickness that will be left at all points can be ascertained before the core is placed in the mold.

Increasing Shop Capacities

Metal Working

NEW ENGLAND

The plant of the New Haven (Conn.) Wire Bound Box Co. was destroyed by fire. Loss, $40,000.

The Gulf Refining Co. will erect a garage and storehouse on Railroad Hill St., Waterbury, Conn.

The New York, New Haven & Hartford R.R. is to erect a large machine shop at New Haven, Conn.

The City Iron Foundry, Lawrence, Mass., owned by Regan Brothers, was destroyed by fire. Loss, $15,000.

The Acme Motor Co., Worcester, Mass., has purchased the large garage of J. W. Doon, in that city. Improvements are planned.

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

The Springfield (Mass.) Crude Oil Engine Company has moved into its new plant and will build crude-oil engines for motor boats.

The plant of Cann & Saul, 49 Market St., Hartford, Conn., manufacturers of steel castings and high-speed drills, was burned. Estimated loss, $20,000.

Manager Pruden, of the Kissel Kar, New England branch, 10 Columbus avenue, Boston, Mass., announces that a new garage and salesroom will be erected before spring.

The Chandler Comb Machine Co., Ayer, Mass., has been capitalized with $50,000 for manufacturing comb machinery. Incorporators, R. L. Chandler, E. W. Carley and J. Q. Edgerly.

The Federal Paper Box Machinery Co., Boston, Mass., has been capitalized with $10,000 for manufacturing paper-box machines. Incorporators, C. Warren, H. F. Bradford and A. Loring.

The Trow & Holden Co., Barre, Vt., has been organized to manufacture stone-working

machinery and supplies. Capital, $100,000. Incorporators, W. M. Holden, E. T. Tobin, Ira C. Lawrence.

The United States Metal Screens Co., Norwalk, Conn., has incorporated with $250,000 capital to manufacture a patented metal screen. A factory has been leased in Norwalk and will be equipped immediately.

The Colonial Manufacturing Co., recently incorporated, at Providence, R. I., will locate a plant in that city for the manufacture of jewelry. Incorporators are H. S. Wirsching, H. Lange and A. Cushing, of Providence.

A corporation, to be name dthe Blackstone Iron & Steel Co., is being formed to be located in the property formerly owned by the Pawtucket Foundry Co., at Pawtucket, R. I. Iron and steel products will be manufactured.

Maintien Brothers & Elliott, Attleboro, Mass., have been incorporated with $100,000 and will locate a plant at that place for manufacture of jewelry. Incorporators are G. H. Maintien, W. F. Maintien, of Attleboro, and C. F. Elliot, of New York.

The Tetrault & Fairchild Manufacturing Co., Hartford, Conn., has incorporated with $25,000 capital to manufacture a patented device for the reaching and handling of packages, etc. Incorporators, Edward O. Tetrault, F. B. Fairchild and Vitaley Cantin, of Hartford.

The J. W. Bowman Co., Boston, Mass., will erect a modern garage and service station on Vassar street, Cambridge, Mass., same to be equipped with independent electric-light and power plant, and modern machinery for automobile repairs.

MIDDLE STATES

The New York Central Ry. will locate repair shops at Miller, Ind.

The Standard Steel Tank Company, Girard, Ohio, is erecting an addition.

Termaat & Monohan, Oshkosh, Wis., will increase the size of their foundry.

A foundry will be erected and equipped by Peter Voelker, at Cleveland, Ohio.

The Illinois Central railroad has plans for a new roundhouse at Champaign, Ill.

The Fox Gun Company, Philadelphia, Penn., is considering removal to Fitchburg, Mass.

The Titan Steel Castings Company, Newark, N. J., will erect an addition to its plant.

Fire in the A. L. Swett Iron Works, at Medina, N. Y., caused a loss of about $25,000.

The Pressed Steel Tank Co. will erect a $27,000 addition to its plant at West Allis, Wis.

Plans have been approved for a new $200,000 foundry at the Washington (D. C.) navy yard.

G. J. Stoff has let contract for a large garage at 821-25 Highland Ave., Philadelphia, Penn.

The flat-wire mill at the plant of John A. Roebling Sons Co., Trenton, N. J., will be rebuilt.

The Pennsylvania Tank Car Company, of Pittsburg, is erecting a plant near Sharon. Company recently incorporated with $50,000 capital.

The Fremont Furnace Co., of Fremont, Ohio, will erect two buildings as additions to its factory.

The Strong Steel Foundry Co., 744 Hertel St., Buffalo, N. Y., will build a two-story pattern shop.

G. F. Mitchell & Son, sheet-metal workers, will erect a new factory on Cedar Ave., Cleveland, Ohio.

The Deming Company, Salem, Ohio, manufacturing pumps, is erecting an addition to its foundry.

The Cleveland Foundry Co., of Cleveland, Ohio, general founder, is erecting an addition to its plant.

The Scripps Motor Car Company, Detroit, Mich., will erect an addition to its plant on Clinton street.

Krainter & Co., Newark, N. J., manufacturing mechanics' tools, will erect a four-story addition.

T. W. Warner Co., Muncie, Ind., manufacturer of auto parts, is planning the erection of a new plant.

A brass foundry will be built and equipped by A. & E. Soban, at 1112-1118 Ansel road, Cleveland, Ohio.

The Abbott Motor Car Co., Detroit, Mich., is building a two-story addition to its assembly department.

The American Furnace Co., 1913 Pine St., Columbus, Ohio, will erect a new plant at 2725-31 Morgan St.

The Massillon (Ohio) Bridge and Structural Co. will erect a new plant and double its present capacity.

The Jenks Lantern Co., Chicago, Ill., has been incorporated to manufacture and deal in electrical appliances.

G. A. Bisler has let contract for a two-story garage at Sixty-first St. and Woodbine Ave., Philadelphia, Penn.

The Buckey Churn Co., Sidney, Ohio, maker of churns, will enlarge its factory and require some machine tools.

The Nickel Plate railroad will make additions to its shops at Conneaut, Ohio, including new 30-stall roundhouse.

The Kiel (Wis.) Motor Car Company, organized by Fred Theissen and Philip Juenheimer, will build a plant.

The Ideal Auto Co., of Fort Wayne, Ind., has doubled its capital and has many improvements and additions planned.

The Wilson Dress Hook Co., Cleveland, Ohio, has raised capital to $150,000 and will need some new hook and eye machinery.

Plans are being prepared for a manufacturing plant, at Mt. Holly, N. J., for the Auto Gas Engine Co. The cost will be $100,000.

The Metal Body, Tank and Fender Co., Cleveland, Ohio, just incorporated, will buy machine tools soon. C. C. Meyer, manager.

Plans have been completed for a factory building of the Security Vault and Sheet Metal Works Co., on Columbus Blvd., Kenton, Ohio.

The Indiana (Ind.) Gas Engine Co. has been incorporated to manufacture gas engines by G. G. Westerfield, I. W. Connaty and S. S. Brewer.

A foundry and machine shop for the Milwaukee School and College of Aviation, recently incorporated for $50,000, is being planned.

Rumsey & Co., Seneca Falls, N. Y., manufacturing pumps and fire engines, are planning to build a new factory to replace their present one.

Isaac A. Sheppard & Co., Philadelphia, Penn., manufacturing stoves, has purchased site at Erie avenue and Sepoiva street, for a new plant.

The Ohio Machine and Boiler Co., of Cleveland, Ohio, boiler manufacturer and general machinist, is erecting a new factory and will need machine equipment.

The Upson Nut Co., Cleveland, Ohio, incorporated to consolidate several large nut- and bolt-making firms, will need machinery to improve some of the plants.

The Standard Gas Engine Co., Milwaukee, Wis., has been incorporated to manufacture gas engines by Edward Cheshire, A. E. and C. H. Welch. Capital, $25,000.

The Larrowe Construction Co., Detroit, Mich., has issued a machinery list, including several metal-working tools, for a sugar factory in the vicinity of Toledo, Ohio.

D. H. & F. H. Lippincott, manufacturers of soda-water apparatus, will let contract for a one-story addition to their plant at Twenty-fourth and Locust Sts., Philadelphia.

The Thornton-Fuller Automobile Co., of Philadelphia, has been incorporated to manufacture and sell motor vehicles by S. S. Thornton, L. Fuller and William Fuller.

Quincy Casting Co., Quincy, Ill., has been organized with $10,000 capital to manufacture castings for stoves, ranges, furnaces, etc., by Chas. Schnellbacher, Willis Geo. Beals.

The Compound Cycle Engine Co., New York, has been organized to manufacture engines, etc. Capital, $30,000. Incorporators, R. W. France, Brooklyn; C. J. Kulberg, J. P. Thorne.

The McHenery Motor Truck Co., of Detroit, Mich., has leased part of the building at 1341 Noble St., Philadelphia, Penn., to be used as an emergency garage to repair motor trucks.

The Empire Gear and Manufacturing Co. has been incorporated at Indianapolis, Ind., with $20,000 capital. Directors are F. S. Clark, C. H. Hurd, H. M. Talbot and A. H. Off.

The Electric Wind Turbine Co., Rochester, N. Y., has been organized to manufacture electric machinery, etc. Capital, $150,000 Incorporators, J. G. Childs, B. G. Tallman, etc.

Bids will be received at Room 392, City Hall, Philadelphia, Penn., until Dec. 19, 1911, for four 10-inch engine lathes. Bids should be addressed to A. F. Hannond, superintendent.

The Flexo-Motor Co., Springfield, Ill., has been incorporated to manufacture mine motors, supplies, etc. Capital, $30,000. Incorporaters, Fred C. Miller, William Wishart, Otto Butzke.

The Marsh Steel Company, Cincinnati, O., has been organized to manufacture and sell iron and steel of all kinds by William L. Spidel, F. E. Marsh, John Sauer, etc. Capital, $250,000.

The Ozone Engineering Co., Philadelphia, Penn., has been incorporated to manufacture electrical ozonizers and general electrical supplies. Incorporators, L. F. Bruce, R. Spaulding, J. Liffman.

The Moocrs Automobile Co., New York, has been organized to manufacture motor vehicles, etc. Capital, $450,000. Incorporators, E. J. Bosse, L. A. Weinstein, New York; G. Leveene, Yonkers.

The Simkin Manufacturing Co., Chicago, Ill., has been incorporated to manufacture au-

tomobile accessories. Capital, $25,000. Incorporators, Walter B. Simkin, Geo. F. Frisz, Frank Greenberg.

The Cleveland Wire Fence Co., Cleveland, Ohio, has been organized with $75,000 capital to manufacture wire fence and other wire articles, by Elmer G. Derr, Sterling W. Cook, A. J. Harvey, etc.

The Prudential Therapeutical Co., New York, has been incorporated to manufacture surgical appliances, etc. Capital, $50,000. Incorporators, M. Crossfield, Jr., L. I. Crossfield, A. I. Jordan.

The Universal Machine Company is removing from Toledo, O., to Bowling Green, O., in a new factory which has 22,000 feet of space. The company manufactures marine engines and bag machines.

The Climax Brass and Manufacturing Co., Chicago, Ill., has been incorporated to conduct a brass and iron foundry and machine shop. Incorporators, John Stuart Roberts, Emerson B. Stoddard, I. M. Adams.

American Sheet Metal and Machinery Co., Chicago, Ill., has been organized to conduct an iron and steel foundry and machine shop by Albert W. Schulz, Hans C. Rosnec, Harry C. Kinne. Capital, $100,000.

The Myers Non-Spreading Rail Tie Co., Toledo, Ohio, has been incorporated to manufacture patented railroad ties by Wellington S. Huntsman, Frank A. Neiberger, Gustavus Olinger, etc. Capital, $10,000.

The Bright Carburetor Co., of Indianapolis, Ind., has been incorporated to manufacture carbureters. Machine equipment will be needed. S. M. Brundage, C. E. Day, H. S. Rominger are the incorporators.

The Motor Efficiency Co., Cleveland, Ohio, has been incorporated with $10,000 capital to manufacture and deal in automobile parts and accessories, by August W. Krumhas, W. K. Caldwell, Edward Younger, etc.

The Bluffton Manufacturing Co., Bluffton, Ohio, has been incorporated with $60,000 capital to manufacture and deal in tools and light machinery, by A. D. Lugibihl, Myron R. Lugibihl, Harley R. Lugibihl, etc.

The Lombard Manufacturing Co., Rochester, N. Y., has been incorporated to manufacture engine starters, mechanical devices, etc. Capital, $30,000. Incorporators, J. C. Lombard, P. W. Hodgkinson, S. C. Ward.

The Brooks Typeline Casting Machine Co New York, has been incorporated to manufacture typesetting and casting machinery. Capital, $25,000. Incorporators, Byron Brooks, 111 Broadway; Geo. H. Cook, 74 Broadway, etc.

The Buffalo (N. Y.) Motor Vehicle Service Co. has been incorporated with $100,000 capital to manufacture, sell and repair motors and mechanical parts for motor vehicles. Incorporators, Wm. R. Huntley, C. M. Baldy, Geo. I. Holender, etc.

The Metal Body Tank and Fender Company, Cleveland, Ohio, has been incorporated with a capital of $10,000 to manufacture automobile tanks and fenders by Chas. C. Meyer, Arthur J. Peet, C. J. Robinson, B. A. Perkins, E. J. Hartman. Capital, $10,000.

The Vitaphone Co., 45 West Thirty-ninth St., New York, has acquired the factory formerly occupied by W. H. Rogers, at Plainfield, N. J., and will equip same with a complete line of metal-working machinery for the manufacture of mechanical parts of talking machines.

The Indiana Steel Products Co., Chicago, will erect another large factory at Valparaiso, Ind. Part of the new space will be used in the manufacture of magnets. The factory will be equipped with traveling cranes and a testing laboratory, using the most modern apparatus.

The Cincinnati (Ohio) Precision Lathe Co. has been incorporated to manufacture small lathes, adjustable reamers, milling machines, etc. Capital, $50,000. Incorporators, M. H. Stewart, W. C. Tatman, J. M. Tatman. Site for plant on Woodburn Ave., in Mt. Washington, has been secured.

The Fire Retainer Heating Co., of Columbus, Ohio, incorporated recently, has been completely organized to manufacture a patented heater of all kinds. Arrangements have been made by which the company will use the plant of the Lattimer Stove Co., on West Spring St., to manufacture its product.

SOUTHERN STATES

The fire department, Augusta, Ga., will erect a two-story repair and machine shop.

The Simmons Hardware Co., of St. Louis, Mo., may locate a branch plant in Baltimore, Md.

A plant for the hardening of steel will be erected in Curtis Bay by George W. C. Beall, of Denwood, Md.

The American Machine and Manufacturing Company, of Charlotte, N. C., has moved its plant to Greenville, S. C.

Additional mechanical equipment is being purchased by the Chesapeake & Ohio Ry. Co. for its shops at Huntington, W. Va.

A four-story plant and factory, to cost $20,000, will be erected by the John Boyle Co., can manufacturer, Baltimore, Md., at Wolfe and Thames Sts.

The White Adding Machine Company, Nashville, Tenn., has secured site on Wedgewood avenue for a plant. The concern is now located in the Hinds Shoe building.

A new manufacturing company, known as the American Furnace-Device Co., Inc., will locate in Baltimore City, for the manufacture and installation of a patented furnace device. The offices of the company are at 444 Equitable building, Baltimore, Md.

WEST OF THE MISSISSIPPI

Tiejen & Ebert are erecting a blacksmith shop at Bigelow, Iowa.

Carl Christianson, of Persia, Iowa, is building a blacksmith shop and garage.

Oscar Olson and L. D. Skorheim, of Chamberlain, S. D., will build a machine shop.

The Central Foundry Company, Oklahoma City, Okla., will erect an addition to its plant.

The Texas Motor Car and Supply Company, Victoria, Tex., is erecting an addition to its machine shop.

The Plymouth (Cal.) Consolidated mines will build a new blacksmith shop, and other shops for repair work.

The Northwest Harvester Co., Spokane, Wash., will build an assembly-shop addition to its iron-working plant.

The Havelock (Neb.) Commercial Club is negotiating with the Burlington R.R. to establish a $1,000,000 coach shop at that place.

The Cushman Power Sprayer Co., Lincoln, Neb., will build a factory at St. Joseph, Mo. It will manufacture gasoline-spraying machines.

The Northwestern Improvement Company, Roslyn, Wash., operating mining properties, will build an addition to its machine shop at Roslyn.

Kern & Wetmore, Deming, N. M., will erect a commercial garage and machine shop on Silver Ave. Modern machinery will be installed.

A. D. Koyer, Los Angeles, Cal., will build an addition to his blacksmith shop on Park View St. Modern equipment will be installed.

The Hay Tool Manufacturing Company, Council Bluffs, Iowa, is rebuilding its plant, recently burned. All kinds of hay tools are manufactured.

Plans are being prepared for a factory building for the Security Vault and Sheet Metal Works on Columbia boulevard, near Kenton, Portland, Ore.

George Healing, Sacramento St., San Francisco, Cal., has taken out a permit to build a new carpenter shop, replacing his plant recently destroyed by fire.

J. S. Ritchey, Merced, Cal., has acquired property on Front St., and will build a commercial garage and machine shop. About $12,000 will be expended.

D. B. Wynne, Bakersfield, Cal., contemplates the erection of a commercial garage and repair plant on Laurel St. Modern equipment will be installed.

The Matthew-Davis Tool Company, 219 North Second street, St. Louis, Mo., whose new plant is about completed, is interested in surface-grinding machines.

M. J. Nolan and George A. Smith, Los Angeles, Cal., will build a new commercial garage and repair shop at 1306 South Main St. The plant will be fully equipped.

J. C. Werick, Point Richmond, Cal., will build a commercial garage and machine shop at Richmond, Cal. The plant will be fully equipped with modern machinery.

The Hamm Brewing Co., St. Paul, Minn., will erect a $12,000 building to be used as a machine shop and blacksmith shop on Cable Ave., between Minnehaha and Margaret Sts.

The Byron Motor Co., Denver, Colo., has secured the plant of the Pueblo Steel Wheel and Wagon Co., at Pueblo, Colo., and will equip same for the manufacture of motor trucks.

The Northern Pacific Ry. Co. plans for the erection of a new roundhouse and repair shops at Parkwater, near Spokane, Wash. It is said that $500,000 will be expended upon the plant.

Donald Lee, Los Angeles, Cal., representing the Cadillac automobile on the Pacific coast, plans for the erection of a modern commercial garage and repair plant at San Francisco, Cal.

The Busch-Sulzer Brothers Diesel Engine Company, St. Louis, Mo., is negotiating for site on which to erect a plant. Will probably be in the vicinity of the Anheuser-Busch brewery.

The Curtiss-Shea-Cox Co., Los Angeles, Cal., recently incorporated, plans for the erection of a plant near Los Angeles, for the manufacture of automobiles. Frank Curtiss is head of the company.

H. H. Meyers, architect, Kohl building, San Francisco, Cal., is preparing plans for a modern commercial garage and machine shop to be erected on Golden Gate Ave. The plant will be fully equipped.

Olaf Olson, Seattle, Wash., has taken out a permit to build a large commercial garage, including repair plant, on East Pine St. The plant will be fully equipped and is estimated to cost $28,000.

The Alaska mine, near Pike, Cal., will build a new blacksmith shop and other working buildings, and install new electric motors, to replace its equipment recently destroyed by fire. George P. St. John is manager.

The Columbia Iron and Steel Co., Portland, Ore., recently incorporated, plans for the establishment of a plant for the rolling of structural iron shapes and kindred products. I. L. Huff and J. C. McGrath are at the head of the company.

The Tri-State Motor Car Co., El Paso, Tex., representing the Ford automobile, is having a new commercial garage and repair plant erected on Franklin St. The plant will be fully equipped. J. W. Kirkpatrick is interested in the company.

The Globe Manufacturing Co., Phœnix, Ariz., has been incorporated with a capital of $500,000 by Vernon L. Clark and W. H. Teasley. The company will establish a plant for the manufacture of plumbers' tools, projectiles and kindred specialties.

In connection with the new polytechnic high school to be erected by the board of education, San Diego, Cal., the manual-arts building will comprise woodworking and turning shops, machine shop, foundry and forge shops and pattern shops. The plant will be fully equipped. Quayle Brothers, architects, San Diego, are preparing plans.

In connection with its new iron-working plant to be erected at Porterville, Cal., the Brisco Iron Works has filed articles of incorporation with a capital stock of $300,000, and principal office at Porterville. The plant will be employed for the manufacture of pumping machinery and will comprise foundry and machine shops. T. A. Brisco and G. V. Reed are at the head of the company.

CANADA

The Harding Motor Car Co. is building a new factory at Newmarket, Ont.

The Western Machine and Supply Co. will locate a new factory at Calgary, Alta.

L. Duhamel will equip a new garage and repair shops at 107 Murray St., Ottawa.

The Wolseley Tool Motor Car Co. will equip a new garage and shops at Toronto.

The Union Furnace Co., of Buffalo, will equip a new factory at Port Colborne, Ont.

The Vancouver Drydock and Shipbuilding Co. will spend $500,000 for machinery, etc.

The Woodstock Automobile Co., of Woodstock, Ont., contemplates extensions to its plant.

Fire did $15,000 damage to the Pink & McVeity garage, at Ottawa. New machinery needed.

The Canadian Two-in-One Auto Co. will locate a new factory at Windsor. S. Cole, manager.

The Katie Foundry Co. will equip a new machine shop in connection with its plant at Galt, Ont.

The Pittsburg (Penn.) Nut, Bolt and Nail Co. has purchased a site in Welland, Ont., where it will build a branch factory next spring to employ from 120 to 200 men.

Plans for the Canadian plant of the John Deere Manufacturing Co., farming implements, at Welland, Ont., Can., are in the hands of contractors and work will be started as early as possible in the spring. It will cost about $1,000,000.

GENERAL MANUFACTURING

NEW ENGLAND

The James Murchie Sons' Co., Calais, Me., will rebuild its sawmill, recently burned.

Fire destroyed the granite plant of N. Pelaggi & Co., Northfield, Vt. Loss, $40,000.

Philip Bardeck will build an addition to his bottling plant on Arch St., New Britain, Conn.

The feldspar mill of the Trenton-Feldspar Co., Cathance, Me., was completely destroyed by fire.

The H. H. Mayhew Co., Shelburne Falls, Mass., will install ten new electric motors in its plant.

The Standard Wash Tray Works, Stiles St., New Haven, Conn., is to erect an addition to its plant.

No. 10 mill of the Tremont & Suffolk cotton mills, Lowell, Mass., was recently badly damaged by fire.

An explosion destroyed the mixing building of the E. S. Hunt & Co. fireworks factory, Weymouth, Mass.

The Bates Street Shirt Co., Lewiston, Me., will erect, in the near future, a five-story addition to its plant.

The Premier Worsted Mills, Wickford, R. I., is removing its equipment to a larger factory at Bridgeton, R. I.

The Lamson & Goodnow Co., Shelburne Falls, Mass., will install 14 new electric motors in its plant.

The large bakery of J. Denomme, Arctic, R. I., was destroyed by fire. Machinery total loss. Will probably rebuild.

The large shoe factory of J. A. Bartlett, Washington St., Haverhill, Mass., was destroyed by fire. Machinery total loss.

Fire destroyed the manufacturing plant of Andrews & Peck, sash and blind manufacturers, at 49 Market St., Hartford, Conn.

The plant of the J. T. Slack Corporation, Springfield, Vt., manufacturer of shoddy, is to be enlarged by several additions, including a dyehouse.

The W. H. Ingalls Co., Lynn, Mass., has been incorporated to manufacture shoes. Capital, $50,000. Incorporators, Wm. H. Ingalls, A. W. Ingalls, etc.

The J. B. Murphy Co., Danbury, Conn., has been incorporated with $100,000 capital to manufacture hats, by James B. Murphy, John Miller and Neil D. Murphy.

The Manufacturers' Waste Co., Boston, Mass., has been capitalized with $40,000 for the purpose of manufacturing cotton waste. Thos. S. Palmer is president.

Work has been started on a new four-story factory for Lewis Hawthorne, of New Haven, Conn., on Chestnut St., and will be used for the manufacture of sashes and doors.

W. H. Wiley & Son, Hartford, Conn., manufacturers of leggings, gaiters, etc., will build an addition to the factory recently purchased on Pliny St. A new boiler house will also be erected.

The Malden Box and Barrel Co. has been organized at Augusta, Me., for the manufacture of boxes and barrels. Capital, $300,000. R. S. Buzzell, president; L. J. Coleman, treasurer.

The York Manufacturing Co., Saco, Me., is building a power plant which, when completed, will be the largest in Maine. Thirty-six huge boilers will be installed in place of the 24 in the old building.

Power and refrigerating plants will be required in The Court Hall, a new apartment hotel to be built in Worcester, Mass., by Thomas D. Galasini and associates. Mr. Galasini is in the State Mutual building.

The large shoe factory at the corner of Jefferson and North Bow Sts., Milford, Mass., has been sold by M. F. Green to a rubber-coat and goods manufacturing concern in Boston, and will be equipped immediately for its use.

MIDDLE STATES

The Fall River (Wis.) Canning Co. will enlarge its plant.

Holt Kain will build an artificial-ice plant at Liberty, Ind.

Beauregard Brothers, of De Pere, Wis., will erect a planing mill.

The Anchor Coal Washery, of Pottsville, Penn., was destroyed by fire.

The A. P. W. Paper Co., Albany, N. Y., has plans for a new two-story mill.

Leonard Scholl & Son, of Detroit, Mich., brewers, are to erect a new plant.

A. F. Connor will install a boiler at 43 South Cruse St., Indianapolis, Ind.

The city of Philadelphia, Penn., is having plans made for a large power plant.

Fire destroyed the power plant of the United States Express Co., at Jersey City, N. J.

Miller Brewery Co. will build a two-story addition at 530-32 West Erie St., Chicago.

The Steubenville Milling Co., Steubenville, Ohio, will erect a new flour and grain mill.

The J. B. Owens Floor and Wall Tile Co., Zanesville, Ohio, will buy some new machine tools.

A gas-producing plant will be built by the American Sheet and Tin Co., at Cleveland, Ohio.

The J. J. Buckley Co., Cleveland, Ohio, will need some power equipment for new cloak factory.

The Buffalo (N. Y.) Incubator Co., 915 Bradley St., will build an addition to its factory.

Work has been started on the bakery building on Fair St., New Haven, Conn., for G. Ferrari.

The plant of the Big Seven Lumber Co., West Mansfield, Ohio, was burned. Loss, $10,000.

The plant of the Fultonville Silk Co., Fultonville, N. Y., was destroyed by fire. Loss, $200,000.

Geneva, Ill., will ask for bids on engine, generator, boiler, etc., for the electric-lighting plant.

The Greenville (Ohio) Electric Light and Power Co. will need some new power-house equipment.

The Iron Clad Mantle Co., Chrichville, O., making gas mantles, will want some new machinery.

The Ohio Varnish Co. will erect a shop on Kinsman Ave., near Eighty-seventh St., Cleveland, Ohio.

The Edgar (Wis.) Veneer and Manufacturing Co. will commence the erection of its plant shortly.

The Schlegelmaier Brewing Co. will erect a five-story building at Wilkes-Barre, Penn., to cost $250,000.

The plant of the Milton & Milton Junction Gas Co., at Milton, Wis., will be rebuilt at a cost of about $6000.

The Delphos (Ohio) Home Telephone Co. has increased its capital and will need new telephone equipment.

P. Whilt will build a laundry at 217-19 East Thirty-fifth St., Chicago, Ill., and equip it with new machinery.

The Paulson Ellingson Lumber Company, Hawkins, Wis., contemplates building a saw mill at Bergville, Minn.

The *Biddle Press* is having plans made for a four-story building at Sixth and Locust Sts., Philadelphia, Penn.

Fire destroyed the power house, machine shop and factory of the James Lee paper-box factory, Jersey City, N. J.

The Indianapolis Cradle Works, Indianapolis, Ind., will build an addition to its factory at Twenty-ninth and Canal Sts.

The plant of the General Chemical Co., of Eleventh and Linden Sts., Camden, N. J., was destroyed by fire. Loss, $10,000.

The substation of the Noblesville Heat, Light and Power Co., at Arcadia, Ind., was destroyed by fire. Will be rebuilt.

The Rochester, Syracuse & Eastern Railroad Company will erect a new power house near its present location, at Lyons, N. Y.

The Puritan Knitting Mills Co. has leased part of the building at 309-13 Arch St., Philadelphia. Will manufacture knitted coats.

The plant of Case & Merry, Maumee, Ohio, window-glass manufacturers, will soon be reopened and new equipment will be needed.

Fire damaged the Buffalo Creek elevator of the Eldad Milling and Elevating Co., Seneca St., Buffalo, N. Y. Loss, about $40,000

The Continental Sugar Co., of Cleveland, is having plans prepared for the construction of a $1,500,000 sugar refinery, at Toledo, O.

The American Headlight Co., Anderson, Ind., is erecting another building for the increased production of locomotive headlights.

The Citizens Ice and Cold Storage Co., Belleville, Ill., expects to replace its 225-horsepower steam engine with gas engine and producer.

Otto C. Wolf & Son, brewers, will erect a five-story brewery and a one-story engine house, at Second and Edward Sts., Philadelphia, Penn.

The Pioneer Pole and Shaft Co., Piqua, Ohio, just incorporated to make wagon and buggy poles and shafts, will buy woodworking machinery.

The Columbia Conserve Co., of Lebanon, Ind., fruit and vegetable canners, will establish a branch plant at Indianapolis, Ind. Will need equipment.

Plans have been completed for the construction of a plant for the Cincinnati Veneer Co., of Cincinnati, to replace the plant destroyed by fire recently.

The Svet Printing and Publishing Co., Cleveland, Ohio, has increased its capital from $25,000 to $50,000. New machinery is to be purchased.

The G. E. Smith Shoe Co., Columbus, Ohio, manufacturer of shoes, has raised its capital to $350,000, and will add new machinery and power equipment.

Marcel Lambeau, of Green Bay, Wis., has the contract for the erection of a condensed-milk plant to be built at New Denmark, Wis., to cost $100,000.

The Spring Valley (Ill.) Coal Co. is contemplating installing belt conveyers to carry fuel from the tipples of each mine to the boiler department.

Contract has been awarded for the erection of a manufacturing building at 506-512 Race St., Philadelphia, Penn. A. Harting & Co., paper manufacturers.

The Waukesha Pea Canning Co.'s plant, at Rice Lake, Wis., has been sold to J. B. Inderrieden Co., of Rice Lake, Wis., which will enlarge and improve same.

A. P. Leavitt and C. S. Rush have purchased the woodworking shop of Henry Dimock, on Center St., New Britain, Conn., and will install some new machinery.

The Quaker City Morocco Co., of Camden, N. J., has purchased a mill, at Reese and Huntington Sts., Philadelphia, Penn., to be used as an addition to its plant.

The Frank Sausage Co., of Milwaukee, Wis., will install a number of motors, and after the first of the year will install new engine, probably high-speed Corliss.

Harry H. Kelly & Son, brush manufacturers, have purchased a three-story factory building, at 1412-16 North Front St., Philadelphia. Will manufacture all kinds of brushes.

The Williams Folding Box Co., Chicago, Ill., has been organized to manufacture boxes. Capital, $10,000. Incorporators, Henry J. Williams, Stephen B. Jones, F. A. Pritze, Jr.

Jamestown, N. Y., is considering the duplication of its water system for fire protection and manufacturing purposes. If this is done it will mean an outlay of about $150,000.

The National Colortype Co., Cincinnati, O., has been incorporated with $50,000 capital to do a general printing business, by Jas. H. Wever, Henry W. Backer, Leo. F. Folz, etc.

The Marsh Steel Co., Cincinnati, O., which has a patented process of steel making, will be in the market for power and other manufacturing equipment. R. M. Fishback, manager.

The Union Mills Company is negotiating to purchase the Malcolm & Co. knitting mill, at Catskill, N. Y., which has been idle for several years. About 150 hands would be employed.

The plant of the Ypsilanti Underwear Co., at Ypsilanti, Mich., has been sold to the Oak Knitting Co., of Syracuse, N. Y. The plant will be reopened and new equipment purchased.

The Dresden (Ohio) Milling Co. is a new concern recently organized to do a general milling business, by T. P. Perkins, L. H. Howell, L. C. Gray, J. H. Taylor and F. C. Somerville.

The Angola Light and Power Company, of Angola, Ind., has been incorporated to furnish light and power. Equipment is wanted. D. M. and A. J. Vesey and W. E. Mossman, stockholders.

The Sandborn Creamery Cooperative Association, of Sandborn, Ind., has been incorporated to do a general creamery business and will need equipment. J. S. Ford, W. F. Stone, stockholders.

M. S. Gleason and R. E. Fisher, both of Mecca, Ind., will build an artificial-ice plant at Hartford City, Ind. The new plant will be of 25 tons capacity and cost in the neighborhood of $25,000.

The Woodburn Gas Co., Woodburn, Allen county, Ind., has been incorporated with a capital of $6500 by E. C. Edgerton, Otto Knoblauch, E. R. Moser and others, to manufacture and sell gas.

The Ohio Valley Lumber Co. has been organized to manufacture hardwood lumber. Walter E. Johns, president; A. W. Mowbray, vice-president. Office, Provident Bank building, Cincinnati, Ohio.

The Home Electric Light Company, of Holland, Ind., has been incorporated to furnish electric light and power. Will need equipment. J. H. Heitman, J. H. Miller, J. F. Overbeck, stockholders.

The Oldenburg Electric Light, Power and Water Works Company, Oldenburg, Ind., has been incorporated with a capital of $5000 by George Holtel, Sr., N. G. Gloshen, B. J. Kessing and Joseph Schmidt.

Allen & Garvey Co., Inc., of New Haven, Conn., have incorporated to manufacture shirts, etc. Capital, $10,000. Incorporators, Frank J. Allen, Henry M. Garvey and Arthur B. O'Keefe, all of New Haven.

The Johns, Mowbray, Nelson Co., of Cincinnati, Ohio, has been incorporated to conduct a general lumber and manufacturing business and will need woodworking equipment. W. E. Johns, principal stockholder.

The Decatur Pana Southern Ry. Co. has been organized with $25,000 capital to construct a railroad from Decatur to Pana, Principal office, Decatur. Incorporators, H. S. Aschroft, J. W. Lockett, H. G. Hodgkins, all of Chicago, etc.

Bids will be received at room 427, District building, Washington, D. C., for installing electric generators and heating and ventilating system for the James Ormond Wilson Normal school building. Information may be had of chief clerk, engineering department.

SOUTHERN STATES

The Tampa (Fla.) Brush and Specialty Co. will erect a new plant.

The City Ice Co., of Baltimore, Md., will erect a large plant on the Falls road.

The bottling factory of Frederick D. Harman, Hagerstown, Md., was partly destroyed by fire.

The New South Brewery and Ice Company, Middlesboro, Ky., will rebuild its plant recently burned.

The Augusta (Ga.) Crate Co. has been organized with $20,000 capital to manufacture crates, bottle cases, etc., by W. B. Toole, G. L. Preacher, H. C. Lorick.

The Hickory, (N. C.) Chair Manufacturing Co. has been organized with $30,000 capital and has let contract for the construction of a building at East Hickory. J. D. Elliott, president.

WEST OF THE MISSISSIPPI

The Hazelton (N. D.) creamery was burned.

B. F. Chase, Wengler, Cal., will build a modern sawmill plant.

The Elgin (Iowa) Canning Co. is erecting a new three-story factory.

Sylvester & Nichols, of Little Falls, Minn., will erect an ice-cream factory.

Pacific, Mo., will issue $15,000 bonds for improvements to its water system.

Hermiston, Ore., will issue $25,000 bonds for improvements to its water system.

The Saylor Coffee Cabinet Co., of Rochester Minn., will build an extensive addition.

Falls City, Neb., will issue $10,000 bonds for the extension of its water system.

The Kohrs Packing Co., of Davenport, Ia., will remodel its plant at a cost of $39,000.

Webster Groves, Mo., will issue $75,000 bonds for improvements to its water system.

Hood River, Ore., will issue $37,250 bonds for improvements to its waterworks system.

Bennington, Okla., will issue $20,000 bonds for improvements to its waterworks system.

The Barr Ice Cream Co. will build a plant at Davenport, Ia. E. G. Holbrook, architect.

The Wise root-beer factory has started construction work on its plant at Webster City, Iowa.

McMinndille, Ore., will issue $30,000 bonds for improvements to its water and lighting systems.

The Waco (Tex.) Sash and Door Company will erect a new factory to cost about $500,000.

Lamar, Mo., will issue $70,000 bonds for improvements to its water system and lighting plant.

The Golden West Brewing Co., Oakland, Cal., is having plans prepared for an addition to its plant.

Butler Brothers, Bonners Ferry, Ida., will build a new sawmill plant at Addie, near Eastport, Ida.

The Palmarejo & Mexican Gold Fields, Ltd., Zapote, Chih., Mex., will install a new aërial tramway system.

The Division Street Marble Works, Spokane, Wash., will build a new marble-mill addition to its plant.

The plant of the Durable Roofing Manufacturing Co., Portland, Ore., was destroyed by fire. Loss, $60,000.

Griggs, Cooper & Co., St. Paul, Minn., will erect a three-story candy factory on University Ave., near Fairview.

The Imperial Power Co., Chehalis, Wash., has awarded contract for rebuilding of its plant wrecked by explosion.

E. M. Jones, of Grand Island, Neb., will build a two-story plant, at Aurora, Neb., to be used as a candy factroy.

The Greater Willows Promotion Association, Willows, Cal., plans for the erection of a modern fruit-canning plant.

The Domestic Water Co., Redlands, Cal., has taken out a permit to build a new sterilizing plant for its water-works system.

The Leagrant Creamery Co., North Front St., Portland, Ore., will make improvements and additions in its creamery plant.

The Sparr Fruit Co., Corona, Cal., will build an addition to its fruit-packing plant. Modern equipment will be installed.

Swift & Co., Chicago, Ill., plan for the erection of a cold-storage plant at Lewiston, Mont. G. R. Nelson, superintendent.

The Young Men's Christian Association, Olympia, Wash., will make improvements and additions in its electric-lighting plant.

The E. K. Wood Lumber Co., Oakland, Cal., contemplates the erection of a branch lumber plant at Richmond, Cal.

The sawmill plant of the Acley Brothers Company, Klamath Falls, Ore., was partially destroyed by fire. The plant will be rebuilt.

Swift & Co., First and Santa Fé Sts., Los Angeles, Cal., have taken out a permit to make improvements and additions in its cold-storage plant.

The lumber-working plant of the Big Basin Lumber Co., Klamath Falls, Ore., was partially destroyed by fire. The plant will be rebuilt.

The Friday Harbor (Wash.) Packing Company plans to increase the capacity of its fish-canning plant. New equipment will be installed.

F. C. Haven, Oakland, Cal., has taken out a permit to build a new sawmill plant on Lake Shore Ave. The plant will be fully equipped.

The city of Tulare, Cal., contemplates the installation of a waterworks system. Sloan & Robson, San Francisco, Cal., are engineers in charge.

F. W. McKenzie, Seattle, Wash., has taken out a permit to establish a laundry plant on East Forty-first St. Modern equipment will be installed.

The Kern Mutual Telephone Co., Bakersfield, Cal., will build a new exchange plant at Fellows, Cal. J. T. Maguire is manager of the company.

The Coleman & Bentel Co., Main St., Los Angeles, Cal., will enlarge its automobile body building and top building, etc., manufacturing plant.

The Arizona Marble Co., Bowie, Ariz., plans for the erection of a large marble-finishing works. John G. Kerr is general manager of the company.

The city of McMinnville, Ore., has voted bonds for $30,000 for improvements and additions in its electric-lighting system and water-works plant.

The Arizona Central Copper Co., Black Hills district, Ariz., plans to install new pumping machinery. J. W. Norton is manager of the company.

The Pacific Fruit Express Co., San Francisco, Cal., is building a new cold-storage plant at North Yakima, Wash. The plant will be fully equipped.

The Gooding, Ida., electric substation of the Great Shoshone & Twin Falls Light and Power Co., Boise, Ida., was destroyed by fire. The plant will be rebuilt.

The Mount Whitney Power Co., Porterville, Cal., plans for the installation of a new electric-lighting system at Visalia, Cal. General manager Maddox is in charge.

The Truckee River General Electric Co., Reno, Nev., will build a power-transmission system in Storey county, Nev. A franchise for the work has been granted.

The Eastern Oregon Light and Power Company, La Grande, Ore., plans for the installation of electric pumping machinery on property in the Grand Ronde district.

The Yakima Valley Creamery Co., North Yakima, Wash., contemplates the erection of a new creamery plant, at Toppenish, Wash. The plant will be fully equipped.

The city of Portland, Ore., plans for the purchase of water meters to fully equip the city. The cost is estimated at $500,000. The city-water department is in charge.

E. G. English, Mount Vernon, Wash., will build a large shingle-mill plant, at Hamilton, near Mount Vernon. The plant will have a capacity of 280,000 shingles daily.

The Bryant & Austin Co., Compton Ave., Los Angeles, Cal., has taken out a permit to build an addition to its asphalt-working plant. Modern equipment will be installed.

The Neglected mine, near Kingman, Ariz., will install new pumping machinery, air compressor and operating machinery. A. E. Hoggett is interested in this property.

The Consolidated Mines Co., Goldfield, Nev., plans for the erection of a modern tramway system at its properties. Herman Zadig, San Francisco, Cal., operates this company.

The city of Salmon, Ida., plans for the installation of a waterworks system to cost $65,000. Bonds for this sum will be voted. The city engineer is in charge of the work.

The Farmers' Mutual Telephone Co., Bellingham, Wash., will build a new telephone system between Bellingham and Sumas, Wash. D. D. Clark is general manager of the company.

The Troy (Ida.) Lumber Co. will remove its lumber-working plant to Lewiston, Ida. The plant will be improved and added to at the new location. E. D. Potvin is head of the company.

The Pendleton (Ore.) Meat Co. plans for the erection of a modern meat-packing and cold-storage plant. About $20,000 will be expended. H. W. Schwartz is president of the company.

The Klamath River Canning Co., Eureka, Cal., plans for the erection of a fish-canning plant on the Eel river. The plant will be fully equipped. G. L. Logan is manager of the company.

F. Auerbach & Brother, Salt Lake City, Utah, have taken out a permit to build a power plant on East Second St., to be used in connection with the company's new department store.

The Mutual Heat and Light Co., Aberdeen, Wash., plans for the installation of an electric-lighting system near Aberdeen. A franchise has been granted. W. Mack is head of the company.

L. E. Booker, Bisbee, Ariz., plans for the erection of a modern sawmill plant at Douglas, Ariz. A logging railroad will be constructed from the Sierra Madres forest district to Douglas.

The Crystal Lake Gold Mining Co., near Bodie, Cal., has commenced the rebuilding of its power plant, which was destroyed by a snowslide last winter. The plant will be fully equipped.

The Greeley-Arizona Irrigation Co., Parker, Ariz., will install a modern pumping and irrigation works plant near Headgate Rock. J. H. Quinton and F. H. Olmstead are engineers in charge.

The Dayton (Ore.) Coöperative Creamery has been organized and plans for the establishment of a modern creamery plant. Samuel Dixon is president, and A. H. Nichols, treasurer of the company.

J. T. Sanderson, chamber of commerce, San Angelo, Tex., is at the head of a company which plans for the erection of a modern woolen-mill plant near San Angelo. The plant is estimated to cost $25,000.

The Kelsey Sash and Door Co., Los Angeles, Cal., has been incorporated by Joseph Kelsey, Wallace L. Tanner and Earl Smith, with a capital stock of $25,000. The company will operate at Los Angeles.

The Rogue River Electric Co., Medford, Ore., will install an electric-lighting plant and distributing system at Woodville, Ore. The Siskiyou Electric Power and Light Company, Yreka, Cal., operates this company.

The city of Newberg, Ore., will install a new pumping plant and make improvements in its water-works. About $20,000 will be expended. Louis C. Kelsey, engineer, Selling building, Portland, Ore., is in charge.

Boiler-plant equipment will be installed in the new building to be erected by the Knights of Columbus, Spokane, Wash. The structure is estimated to cost $75,000. Julius Zittel, architect, Spokane, has prepared plans.

The Willamette Casket Works, Tacoma, Wash., contemplates the erection of an addition to its wood-working plant. The capacity will be increased, and new equipment installed. About $50,000 will be expended.

A boiler plant will be erected in connection with the new conservatory plant to be erected by the city of Seattle, Wash., at Volunteer Park. About $25,000 will be expended. The Seattle Park Board is in charge.

The Western Grain and Sugar Products Company, Agnew, Cal., plans for the erection of a plant at San Jose, Cal., for the manufacture of glass. Modern machinery will be installed. P. A. Brangiel is general manager.

The Spokane (Wash.) Paper and Cigar Box Company has been acquired by A. Fisher and J. Ehrlich. The new owners will increase the capacity of the plant and install new machinery for the manufacture of its specialties.

The fish-canning plant at Ketchikan, Alaska, of the Fidalgo Island Packing Company, Anacortes, Wash., recently destroyed by fire with a loss of about $100,000, will be rebuilt. It is said that the capacity will be increased.

The Santa Fé Railway Company plans for the erection of an ice-manufacturing and refrigerating plant at Sweetwater, Tex. The plant will cost about $75,000. L. J. Prather, Santa Fé Refrigerating Department, is in charge.

The Provident Investment Co., Los Angeles, Cal., plans for the erection of an electric-lighting plant and the installation of a telephone system at Modoc, Cal. C. B. Zimmerman, Modoc, resident manager, is in charge.

The State Engineering Department, Sacramento, Cal., has approved plans for the erection of a power plant at the Southern California hospital, at Patton. The plant is estimated to cost $12,000. State Engineer Ellery is in charge.

The Hoagland Electric Company, Los Angeles, Cal., has been incorporated with a capital of $1,000,000 by J. N. Kelman, of the Kelman Electric and Manufacturing Company (manufacturer of oil switches), H. A. Hoagland and John M. Marshall.

The Glendale (Cal.) municipal lighting plant has acquired the electric-lighting system of the Glendale Light and Power Co., in West Glendale. The new owners will make extensive additions and improvements in the system. H. B. Lynch is manager.

The City Electric Company, San Francisco, Cal., has had plans prepared for a new electric substation plant to be erected in the southern part of the city. The plant will be fully equipped. Samuel Napthaly, Shreve building, San Francisco, is engineer.

H. S. Warren & Co., Detroit, Mich., has acquired property on Fifth St., Portland, Ore., and will erect a large public-market building. The plans will include a large refrigerating plant to be erected in the basement. The structure is estimated to cost $400,000.

The Castlerock (Wash.) Light and Power Co. has been incorporated with a capital of $250,000 by H. B. Davis, A. E. Braden and I. W. Selden. The company will build an electric-lighting plant at Castlerock. Head offices will be established at Tacoma, Wash.

The Appleton Land, Water and Power Company, Los Angeles, Cal., has been incorporated by E. N. Greenleaf, H. M. Brown and A. G. Stepper, with a capital of $300,000. The company plans to operate in the light and power and water business in this section.

The Valley Development Co., Lewiston, Ida., has been incorporated by F. H. Nourse, E. Kilham and E. H. Booth, all of Lewiston, with a capital of $100,000. The company plans for the erection of a power plant, near Lewiston, and for operations in electric power work.

The Omaha Tank and Manufacturing Co., Nebraska City, Neb., has acquired property near Twenty-sixth St., San Diego, Cal., and plans for the erection of a plant for the manufacture of steel and wood tanks, and similar specialties. It is said that construction will commence at once.

The Pacific Power and Light Company, Portland, Ore., will make extensive improvements and additions in its electric-lighting substation at North Yakima, Wash. The company also plans for the construction of a power and lighting system at Horseshoe Bend and Wahkiacus Heights, Ida.

The Commonwealth Lumber Company, Seattle, Wash., has been incorporated by George N. Skinner and L. B. Stedman, with a capital of $150,000. The company will maintain offices at Seattle, and plans for the establishment of a plant for the manufacture of doors, sashes, frames and similar products.

The Pacific Light and Power Corporation, Los Angeles, Cal., will build an extensive system of power-transmission lines in Fresno and Tulare counties, Cal., in connection with its proposed power plant at Shaver, Cal. Franchises for the work have been granted. It is said that the lines will cost $10,000,000.

E. P. Dargin, Portland, Ore., is at the head of a company which plans for the erection of a mill for the manufacture of packing, linen waste and other flax products. The machinery, it is said, will be especially constructed. Mr. Dargin's address is care of the Oregon Development League, Portland.

James H. Owens, San Francisco, Cal., plans for the erection of an electric power plant on the Smith river, near Crescent City, Cal., with a generating capacity of about 2000 horsepower. A power transmission system will be constructed. Sidney Sprout, electrical engineer, San Francisco, is in charge.

The Merced River Electric Power Co., San Francisco, Cal., has been incorporated by L. M. Gove, H. L. Breed, C. Gross and M. S. Hamilton, with a capital stock of $1,000,000. The company plans for extensive operations in the power and lighting business in the Merced River district. Offices will be at San Francisco.

W. M. G. Settles, Butte, Mont., is at the head of a company which plans for the erection of an electric power plant in the Box cañon district, near Vale, Ore. The plant will have a capacity of 9000 horsepower. Electric pumping plants will also be erected in this section. The work is estimated to cost $2,000,000.

The Mountain States Telephone and Telegraph Co., Denver, Colo., has acquired the property of the Mutual Telephone Co., at Lewiston, Mont. The new owners will make extensive improvements and additions in the system and plan for the erection of a new local exchange plant. James E. Jennings, Lewiston, represents the company.

The American Safety Powder Co., Portland, Ore., has acquired a site on Sauvies island, near Portland, and plans for the erection of a large powder-manufacturing plant. The company is said to be planning for the erection of a similar plant at Alviso, near San Jose, Cal., where it has secured a site. A. W. Hedrick is president of the company.

The Nevada Valley Power Company, Reno, Nev., has been incorporated with a capital of $2,500,000 by A. D. Ayers, H. D. Danforth and A. A. Smith, of Reno, and Milton S. Hamilton and J. F. Early, Oakland, Cal. The company has a power site on the Truckee river, near Vista, Nev., and plans for the erection of an electric power plant of 4000 horsepower capacity.

CANADA

Southampton, Ont., will buy an electric power pump.

Beachville, Ont., will spend $6000 on electric equipment.

St. Mary, Ont., voted $15,000 for powerhouse equipment.

Tenders will be called for at Galt, Ont., for centrifugal pumps and motors.

The Saskatoon Milling Co., of Saskatoon, will install an electric power plant.

Port Credit will vote on the advisability of installing an electric-light and power system.

The Commercial Box and Envelope Co., Ltd., of Canada, is being organized at Kingston, Ont., to take over several box and envelop concerns. Benjamin B. McFadden, of the Commercial Envelope Co., of Kingston, N. Y., is president of the new concern. Plant covering four acres will be erected at Kingston.

FOREIGN

The Fuerza & Ferrocarriles Company, Pachuca, Mex., plans for the erection of a hydroelectric power plant on the Tula river, with a capacity of about 8000 horsepower. The company will also build a power transmission system to serve the Actopan, Tula Jasso, and other mining districts. A concession for the plant has been asked from the government. Theodore Branderburg is general manager.

Mining

A new stamp mill of about 40 stamps will be installed at the Pacific mine, Eldorado county, Cal.

A mill and cyanide plant will be built at the Gueriguita mine, about 30 miles south of Nacozari, Sonora, Mexico.

A stamp mill will be installed at the Kalispell-Lincoln property, in the West Fisher mining district, Lincoln county, Mont.

Business Items

The Carborundum Co., Niagara Falls, N. Y., has received announcement of the award of the grand prize for its exhibit of abrasive materials at the Turin Exposition.

The Cincinnati upright drilling and tapping machines and Cincinnati Bickford radial drills exhibited at the International Exhibition, Turin, Italy, received the "Grand Prix."

Forthcoming Meetings

Society of Automobile Engineers, annual convention, New York City, January 18-20, 1912. C. F. Clarkson, general manager, 1451 Broadway, New York City.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month. Hotel Bellevue. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North,

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

Calipers: Welles Caliper Co., Milwaukee, Wis.

Sachs' standardized tool requisitions; mechanical drawings. J. J. Sachs, Lynchburg, Va.

We buy or pay royalty for good patented machine or tool. Box 282, Amer. Machinist.

Wanted—Work for screw machines and gear cutter. Box 775, American Machinist.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

We build to order light machinery, tools, jigs, subpresses and dies; high-grade work. The Elgin Tool Works, Elgin, Ill.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc, MacCordy Mfg. Co., Amsterdam, N. Y.

Who manufactures in large quantities, auto rivets, bored and hardened; offers under Ke. 2381, to Rudolf Mosse, Elberfeld, Germany.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Tool tempering chart, printed in colors with full description; 13½x9½ inches; 10 cents postpaid. Spon & Chamberlain, 123 Liberty St., New York.

Wanted—High grade machine work in quantities for gear cutters, hand turrets, milling machines, etc. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Small shop holding valuable automatic machine tool patents, desires machinery agency to finance expansion necessary for manufacture and sale of same. Box 620, Am. Mach.

Inventors—My patents protect your invention absolutely; moderate rates; convenient payments arranged if desired; information offered gratis. Benjamin Roman, Park Row building, New York.

For Rent—Moving into new plant, will rent present adjoining factory with large modern brass foundry; cheap electric power; 15,000 square feet; rent low. Rushmore Dynamo Works, Plainfield, N. J.

Simple, meritorious inventions bring profits, often fortunes; mail description of your invention for free, candid opinion and estimate to apply for patent. E. P. Thompson, M. E., Victor Bldg., Washington, D. C.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, Amer. Mach.

A strong, old established manufacturing company, with a national selling organization, wants to add a new line of building material or construction specialty to manufacture and sell. Address "X," Box 617, Am. M.

Technical patents are best taken care of by an engineering patent attorney, with sound practical experience, both as an engineer and as an attorney; highest references. G. M. Sacerdote, M. E., and Reg'd Patent Attorney, 1919 Broadway, New York City.

A valuable system of patented piston rings, for pumps, compressors, oil, gasolene and steam engines, maximum compression, long life, 40 per cent. saving in manufacture. Information obtainable by addressing Lewis R. Compton & Co., 50 Church St., New York City.

Wanted—Second-hand milling machine that is in first-class condition of the size and quality of the No. 4 Cincinnati plain miller with vertical head attachment. Write description and full particulars of what you have to offer together with price to the Campbell Motor Co., Wayzata, Minn.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Company, Inc., 40 West 13th St., New York City.

Help Wanted

Classification indicates present address of advertiser, nothing else.

INDIANA

Wanted—Foreman for automobile road testing department; technical man preferred; state salary expected. Box 665, Am. Mach.

MARYLAND

Wanted—Man especially experienced in furnace designing and construction, oil, gas, coal, coke; all kinds heating, forging, welding, melting, etc.; state qualifications, experience and salary. Box 678, American Machinist.

MASSACHUSETTS

Wanted—For concern manufacturing small interchangeable quantity work, general foreman to supervise production in tool, automatic screw machine and other shop departments; must be a practical man with actual experience on modern machine tools, able to operate any machine tool, and familiar with rapid production under piece rate system; steady position to energetic man with ability to efficiently handle men; in your reply state age, nationality, experience, places and periods of employment and salary expected. "F," Box 1574, Springfield, Mass.

MICHIGAN

Wanted—Machine shop foreman to build special machinery; must have good executive ability and experience as designer and draftsman; state age, experience, salary expected, former employees and references. Sommers Bros. Match Co., Saginaw, Mich.

MINNESOTA

Wanted—Gisholt lathe hands, steady employment, good wages. Apply Campbell Motor Co., Wayzata, Minn.

NEW JERSEY

Tool designers wanted on large and small tools; state age, experience and salary expected; location in the East. Box 684, Am. M.

Wanted—Man to take care of card records, stock list and order systems in drawing room; must be good penman, rapid and absolutely reliable; good position for right party. Saurer Motor Co., Plainfield, N. J.

NEW YORK

Wanted—An A-1 machinist. Box 680, Am. M.

Wanted—Assistant foreman for machine and tool making shop located in western New York. Box 679, American Machinist.

Wanted—An energetic young man having experience in production end of shop doing fine work; unusual opportunity for tactful, capable man. Write, giving references. Box 674, American Machinist.

Press shop foreman, in manufacture small and medium size drawn articles from light gage steel; none but experienced and successful men considered; write in confidence, giving full particulars as to experience, age and salary expected. Box 682, Amer. Mach.

Tool Designers—Experts on punches and dies; only topnotchers capable of earning big money need apply; a first-class proposition for the right kind of man; work in New York City. Write, stating age, nationality, experience and salary expected, to "Tools," care of Allen Agency, 45 West 34th St., New York.

Draftsmen—Thoroughly familiar with machine shop practice on small interchangeable parts of electrical apparatus; position only for first-class men capable of earning the top market price; no others need apply. Write, stating age, nationality, experience and salary expected, to "Draftsman," care of Allen Agency, 45 West 34th St., New York.

OHIO

One draftsman wanted. Box 683, Am. M.

Wanted—Designer and draftsman who is thoroughly familiar with presses, shears and special machinery. Box 561, Amer. Mach.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Machine designers wanted; one experienced on small automatic grinding machinery preferred; state experience and wages expected. Standard Roller Bearing Company, Philadelphia, Penn.

Wanted—A manufacturer of engines and boilers wants a foundry foreman; employing 40 to 50 molders and coremakers. Address "Manufacturer," American Machinist.

Wanted—Draftsman experienced on machine tool work, and capable of designing tools and fixtures; state age, salary and references. Box 645, American Machinist.

Wanted—Diemaker for small pressed steel stampings; state age, experience, and give reference; steady employment for the right party. McDowell Manufacturing Company, 541 Wood Street, Pittsburg, Penn.

Wanted—Two assistant shop superintendents at $5.04 per diem each; a competitive examination will be held at the navy yard, Philadelphia, Penn., January 8, 1912, for filling the above positions. For further information address "Commandant," Navy Yard, Philadelphia, Penn.

Bilgram gear generator operator wanted, experienced on cutting automobile bevel drive gears and pinions; only thoroughly competent men need apply; state experience and wages expected. Standard Roller Bearing Company, Philadelphia, Penn.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

TEXAS

Expert foundry man, also expert machinist, who can invest money and take charge of large foundry and machine shop in respective departments in liveliest city in Texas; plant to be reorganized and extended; bonus in stock given to satisfactory parties. Box 686, Am. M.

Situations Wanted

Classification indicates present address of advertiser, nothing else.

ILLINOIS

Uptodate mechanical engineer and expert is open for engagement after February next; 25 years' experience in designing and superintending manufacture of small high-class machinery, tools and fixtures. Box 673, American Machinist.

MASSACHUSETTS

Toolmaker and designer, 37, twenty years' experience, jig fixture and experimental expert, operation writer, technically educated, now sub-foreman, wants place in shop or office; can go January 1. Box 690, Am. Ma.

Toolmaker, 38, fifteen years' experience, jig, fixture, gage, experimental, on close accurate work; now assistant foreman; would like position with chance of advancement. Box 681, American Machinist.

MINNESOTA

Superintendent, experienced in modern machine shop practice, specialist on tools and methods for reducing costs; tactful with men. Box 663, American Machinist.

NEW JERSEY

Mechanical engineer, expert machine designer, desires position. Box 628, Am. Mach.

Designer, experienced on automatic machinery, dies, tools, etc., wants position. Box 483, American Machinist.

Wanted—Position as general foreman or foreman; 10 years' experience as foreman and master mechanic; good executive; best references. Box 664, American Machinist.

NEW YORK

Experienced designer of Diesel oil engines desires position. Box 557, Amer. Mach.

Draftsman, ten years' wide experience, designing special and automatic machinery; original, fast and accurate. Box 635, Am. Ma.

General superintendent, now employed, would consider change; practical machinist; good organizer; familar with uptodate practice; first-class references. Box 688, Am. M.

Machine shop foreman or superintendent; 20 years' experience, medium and high-speed steam engines, boilers, pumps, etc.; good executive; hustler; reference. Box 689, Am. M.

Designer, would like to communicate with a concern having open a permanent position for a first-class man with ten years' practical shop and office experience on jigs, fixtures and special machinery. Box 614, Amer. Mach.

A designing draftsman is open for employment; experience Corliss steam engines, air compressor, rock drills, tools and fixtures; capable and ambitious; can furnish A-1 references. Box 685, American Machinist.

Die casting superintendent desires change; 15 years' experience, all branches; exceptional executive ability; energetic, progressive, systematic, resourceful, reliable, expert, alloys, dies, casting machines, marked sales ability. Box 692, American Machinist.

Mechanical engineer, college Berlin, Germany, 10 years machinist, designer, estimator, assistant of manager, with A-1 automatic tool and special machine concerns, desires a change; expert cost reducer; best references; location immaterial. Box 691, Am. Mach.

OHIO

Wanted—Position as general manager, fairly practical and experienced in the handling of manufacturing plants, consisting of main office and such departments as engineering, machine, foundry, blacksmith, boiler, wood and kindred departments; will take charge on salary or commission, or both, and with highest degree of productive efficiency; guarantee open shop and freedom from labor troubles. Box 687, American Machinist.

For Sale

For Sale—Brass foundry, located on the Central Railroad of New Jersey. Address "Good Investment." American Machinist.

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Talks With Our Readers

By The Sales Manager

AMERICAN MACHINIST,
New York.

Dear Sirs:-

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Somehow I would about as soon think of playing cards with my wife to see which should pay for a dinner as to try to earn a free subscription, and I have made quite a number of subscribers, too.

I know four dollars looks as big to me as to any other man similarly situated, but I'll pay for my paper while in the machine business, which in my case seems likely to be a lifetime.

Don't forget in the meantime that I am and shall continue to be at your service if there is anything I can do. In passing let me say that one idea gleaned from the AMERICAN MACHINIST netted me $5000 in good, hard money.

I do not, however, consider the $5000 (it is really more) gained by that idea, as the measure of the value your paper has been to me. The real value was when it made a foreman out of a machinist or when the lathe hand was given charge of a night crew, or when the present G. F. takes a step higher.

Yours truly,

J. A. SCULLY,
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We have put before him—and you—each week, suggestions, plans and ideas.

To Mr. Scully belongs the credit of intelligently reading, grasping the thoughts presented, and fitting them to his business.

Some of the good things were no doubt in articles describing work entirely foreign to his line of work.

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* * *

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* * *

Only reliable products can be continuously advertised.

Making Millions of Electric Meters

By Fred H. Colvin

The making of electric meters for household use presents the problem of securing accuracy at a minimum cost; the question of outside finish is not important.

These problems include the finest electrical work, and watch-factory methods for making jeweled bearings and pivots in large quantities and at a low cost.

The methods shown are the result of long experience which includes the making of nearly 3,000,000 meters.

The making of electric meters combines, perhaps, more than any other manufactured product, plain and comparatively rough machine work with the utmost accuracy and delicacy. Few of us realize, when we see a small electric meter in a very plain looking case, set up in an out-of-the-way corner, that extreme refinements are necessary to produce it. For to make a meter that shall be commercially accurate, and at the same time consume so little energy in its operation as to be negligible in dollars and cents at the end of the year, is no easy task.

Although the meter bearings do not come first in the process of manufacture, they are of prime importance in the operation of the meter, and for that reason will be mentioned first.

Where Ball Bearings Are Not Delicate Enough

We are very apt to consider balls as the last word in producing frictionless bearings of light-running machinery, and it is somewhat disconcerting to learn that these cannot even be considered in electric-meter construction. It appears that as yet no ball bearing has been developed that will at all satisfy the extreme requirements for a meter bearing. The friction of the finest ball bearing has been found to be entirely too great for this work and the bearing question for meters may be said to begin where ordinary ideas of friction leave off.

The armature of the meter must start with the passing of the current consumed by throwing in a single lamp in the circuit, must run accurately at all loads and in proportion to them, and at the same time must get along with almost no attention.

The jewel bearing is generally used although on account of the far better wearing qualities of the diamond, the latter is coming into more popular use for meters having comparatively heavy moving elements or where the amount of revenue derived from a single meter is so large that a small error in registration is a serious matter. The life of the diamond jewel as used in watt-hour meters is many times that of the sapphire and it unquestionably warrants the higher initial expenditure in many cases.

Bearing Pressures of 300 Tons per Square Inch

With ordinary bearings we find the greatest pressures in locomotive practice, these ranging from 200 to 300 pounds per square inch. With these jewel bearings we are astonished to learn that, in spite of the very small weight of the moving parts, the average bearing pressure is 200 tons per square inch, and are informed that in some cases this reaches 300 tons per square inch of projected area.

This seems almost incredible until we consider that the radius of curvature of the bearing in the bottom of the shaft is less than that of the cupped jewel so that theoretically there is but a single point of contact. Practically, however, there is an appreciable area of contact due to the enormous pressure causing a slight deformation of the bearing surface.

In operation the electric meter is simply a small motor, whose armature receives a small proportion of the current going to the lamp or motor and which is revolved by it. Mounted on the same shaft is an aluminum disk which rotates between the poles of a permanent magnet, whose action may be likened to that of a brake, which regulates the speed of the armature shaft, so as to secure an accurate registration of the amount of energy used. In some meters there is a regular armature mounted on this shaft, which revolves between fields as in a

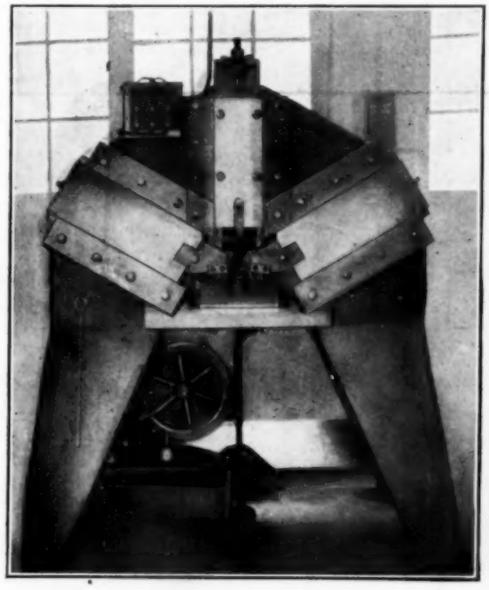


Fig. 1. Magnet-bending Machine

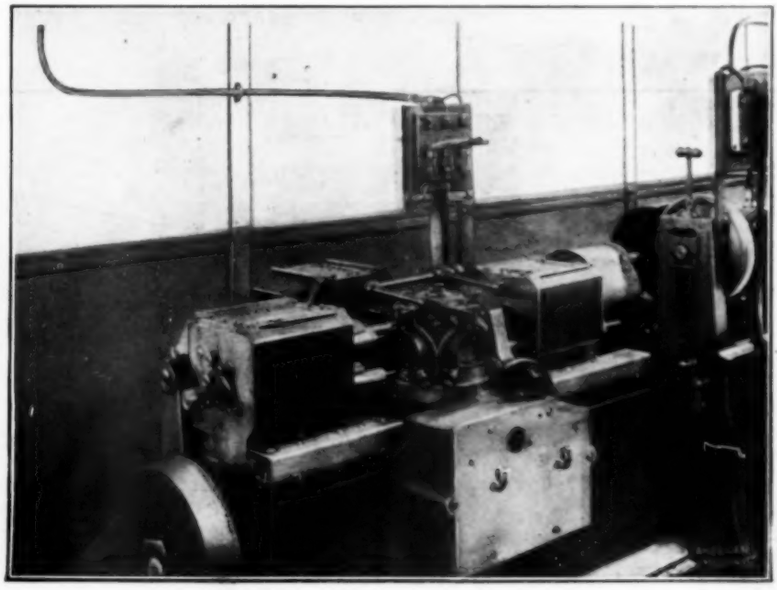


Fig. 2. Driller for Meter Magnets

large machine, but in the Type I meter shown, one side of the aluminum disk is acted on by the electro-magnet shown in place in Fig. 8, and the other side by a permanent magnet. The position of a permanent magnet relative to this aluminum disk controls the speed at full load and the proper adjustment of a plate of conducting material (light load plate) over the poles of the electromagnet compensates for friction, so that the meter will read accurately both large and small loads.

Some idea of the small amount of power involved may be obtained when we learn that it has been figured out by the electrical engineers that a meter of this type under full load develops 0.000003 horsepower. It is also interesting to note the bearing pressure that can be sustained by jewels.

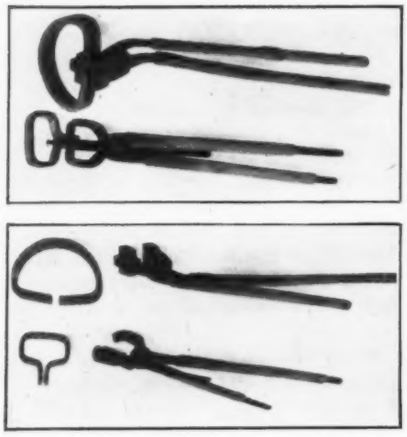


FIG. 3. TONGS FOR HOLDING MAGNETS

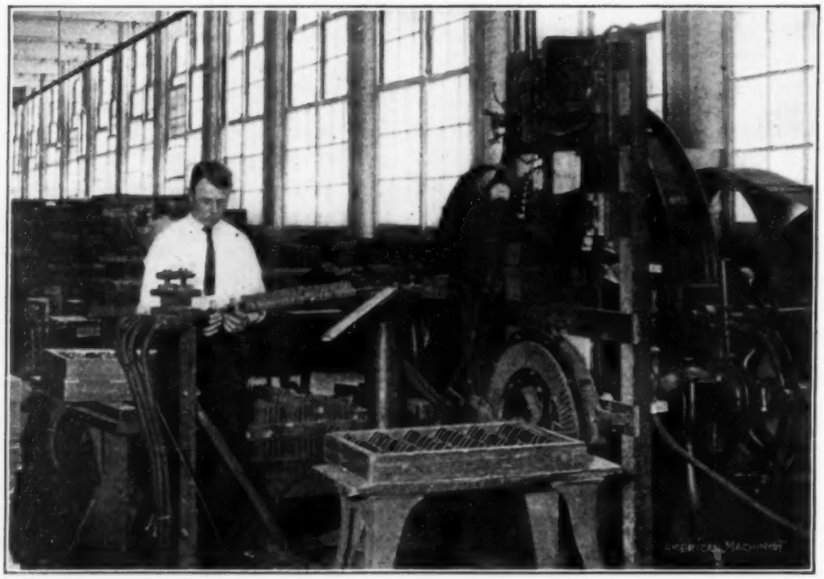


FIG. 4. MAGNETIZING METER MAGNETS

BENDING AND DRILLING THE PERMANENT MAGNETS

One of the new machines that have been recently developed for bending the permanent magnets is shown in Fig. 1. This work was formerly done in a horizontal bulldozer type of forging machine requiring two operations, the first bending the magnet into a U-shape, and the second putting in the final bend.

In the machine shown this is accomplished in one operation by the combination of the vertical and angular slides shown. The vertical slide descends upon the flat piece held on the die block and gives it a U-shape. Then the angular slides advance to close the ends.

The magnet bars having been cut off to proper length, are placed in a continuous heating furnace and are taken off as they come through at the proper heat for bending. These are placed in the machine by one man and taken out, inspected, and gaged by two others; from here they pass along either to be milled, drilled and tapped, or simply drilled and tapped, according to the style of magnet.

In the type of magnet shown in the Type I-10 meters which are illustrated herewith, the gaps between the ends of the magnet are milled with fixtures in a regular milling machine and afterward go to the automatic drilling and tapping machine shown in Fig. 2, which handles them very accurately and in exact duplication.

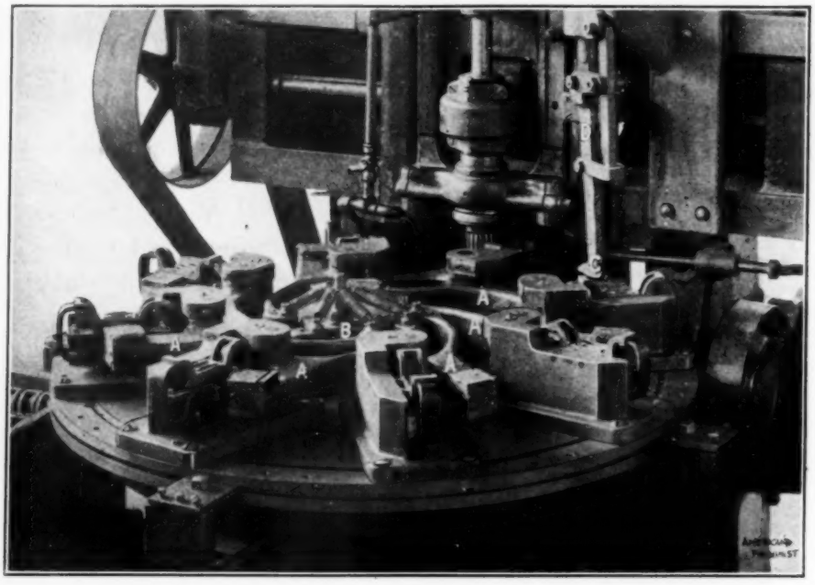


FIG. 5. AUTOMATIC MILLER FOR METER-MAGNET SHOES

The magnets are inserted and removed while the turret is in the front position, and after it swings around to the right, in front of the drilling head, a jig plate with hardened bushings swings into position and guides the drill into the desired point on the magnet. The next operation is the countersinking of these holes by the head at the back, while the third and last head taps the holes for the screws which hold the magnet in place in the meter base.

It will be noted that the magnets are held in place by three cone-pointed screws which make a very substantial form of clamp, and that they are located by a tongue which fits into the opening between the poles. These machines will handle from four to six magnets a minute, completely drilled, countersunk, and tapped. They are then ready for the hardening room.

HARDENING THE MAGNETS

There is a very complete hardening room for handling the magnets which are made of a special alloy steel containing a considerable percentage of tungsten. These are heated by being passed continuously on a conveyer through a gas furnace which heats them very evenly. As they have previously been drilled and tapped for the screws which fasten them

to the meter base, these screws are put in place and left during the heating and quenching in order to prevent fire cracks.

Special tongs are provided for grasping the magnets by the ends as they come through the furnace, so as to hold them

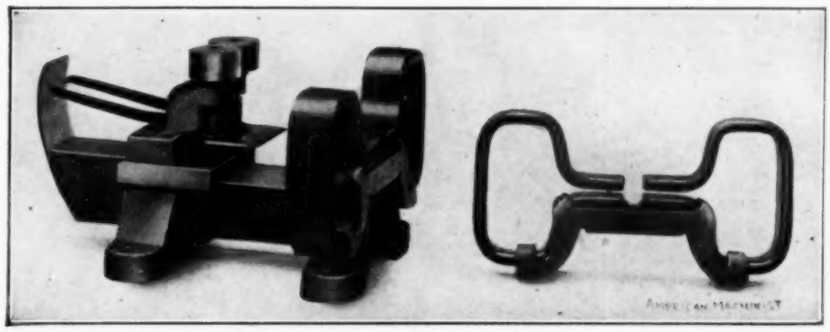


FIG. 6. TESTING THE MILLED SURFACES BY THE AIR GAPS

firmly while quenching and to prevent the springing which might naturally occur at the open ends of poles. Some of these tongs are shown in Fig. 3, different shapes being provided for each kind of magnet.

The magnets are all dipped by hand in brine, which is kept at a constant temperature by being continuously stirred by an air jet coming in from the bottom. The men become so expert in handling these magnets that there are extremely few failures, and they can secure better

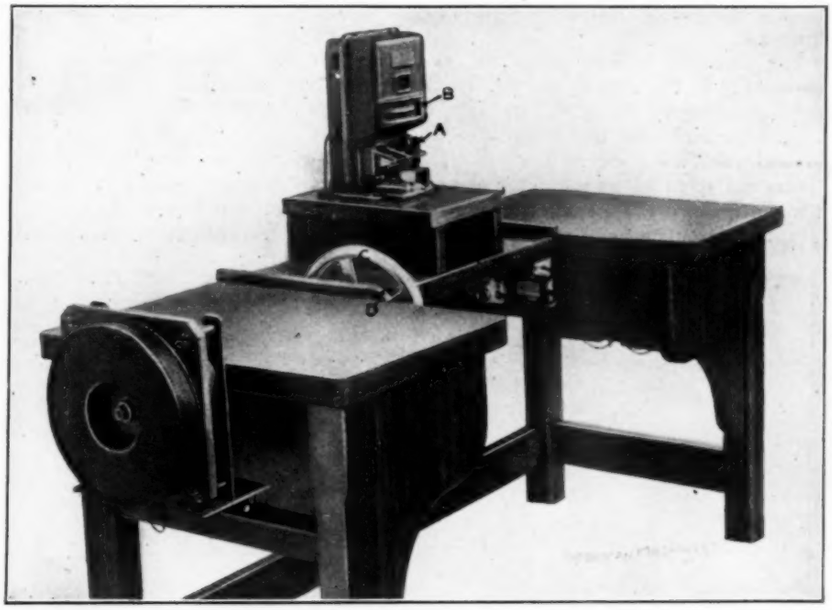


FIG. 7. MACHINE FOR MEASURING MAGNET STRENGTH

results as a rule than the representatives of the makers of the steel.

These magnets are made as hard as fire and water can make them and are not drawn in any way; but in spite of this they are extremely tough and require a heavy blow on a chisel or wedge placed between their points in order to produce a fracture. The fracture, needless to say, is extremely fine and pleasing to the eye.

TESTING EACH LOT OF STEEL

As an instance of the care exercised in the construction of the whole meter, we may cite the question of magnets. Whenever a shipment of magnet steel is received pieces of the right length are cut from 300 different bars, each bar coming from a different bundle and magnets are made from these in the regular way and carefully tested as to magnetic strength. At the same time samples of the steel are being tested both physically and chemically, while other tests show the magnetic qualities. If the magnets fail in any way to meet the standard requirements, the steel is rejected, although another similar test will be made if the manufacturer demands.

MAGNETIZING THE PERMANENT MAGNETS

After the magnets have been hardened they are brought to the special motor and dynamo shown in Fig. 4 to be magnetized. In some cases they are magnetized after being mounted on the back of the meter frame, but in the type of magnet shown in the illustration the magnetizing is done before mounting. These magnets are slipped over the copper bar shown and the outer end of the bar placed in the support, which is a terminal for the current, and the keepers put in place between the poles to complete the magnetic circuit. With the generator running, its field switch being open, the bar carrying the magnets is short circuited across the generator terminals. The field switch is then closed and the field current is allowed to build up until about 10,000 amperes are passing through the magnetizing bar. This takes but an instant, and after the circuit is open the bar is swung out of the support and the magnets removed to be replaced by a fresh batch.

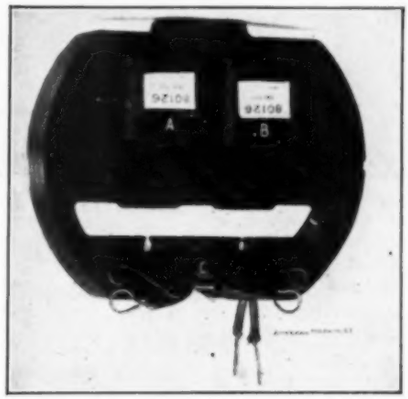


FIG. 8. COMPLETE CORE-TYPE METER I-10

FIG. 9. PLACING THE LAST STAMPING

"AGING" THE MAGNETS

In order to avoid what is known as the "aging" of permanent magnets, and to prevent a change taking place in the magnets while in service in the meter, they are aged by a special process which has been used for some years. This process consists simply of having a thin copper disk revolving at high speed, of such thickness as to pass freely between the opening or air gap in the magnet, and allowing this to revolve a few seconds between the magnet poles.

This is easily done by mounting these copper disks on what is essentially a

grinder stand supplied with a rest, not unlike some of the regular grinder rests, on which to support the magnet being aged. The revolving of the disk in the magnet gap sets up magnetic disturbances which are very much more serious than any to which the meter will be subjected in practice and leaves the magnet proof against disturbances of less magnitude resulting in a magnet having permanent strength.

Automatic Millers

The magnets are mounted and connected by a bronze shoe, which is surfaced on an automatic machine.

Fig. 5 shows a profiling miller which has had a special table attached for automatically milling the surface of the meter magnet shoes where they attach to the meter frames, which were shown being milled in a previous operation.

This consists of the circular table carrying eight special vises for holding the magnets which have their shoes already mounted, as can be seen from those shown in different positions. The magnet poles slide over a steel centering plate, shown. These can be placed in the clamps at almost any position until the table revolves near the clamping point, which allows considerable leeway for the operator in loading and unloading the work.

The clamping is done easily and automatically by the various arms *A*, which are controlled by the stationary cam *B* in the center. As the table revolves around this, the ends of the clamping levers are acted on by the different portions of the cam and the outer end swung against the magnets before the shoe comes in contact with the milling cutter. The device shown at *C* is for automatically insuring that the magnet and shoes are properly seated in position before being clamped. This is a weighted presser foot which squares the magnet on the steel shoe, the clamping action taking place just after the work passes this point.

Testing the Position of the Air Gaps

After the magnet shoes have been milled in the machine shown the magnets go to the little gaging machine shown in Fig. 6 and every one is tested to see how the milled surface lines up with the air gaps between the magnet poles.

Each magnet is placed on the milled surface of the shoe and moves until the chisel-shaped ends of the gage center themselves between the magnet poles.

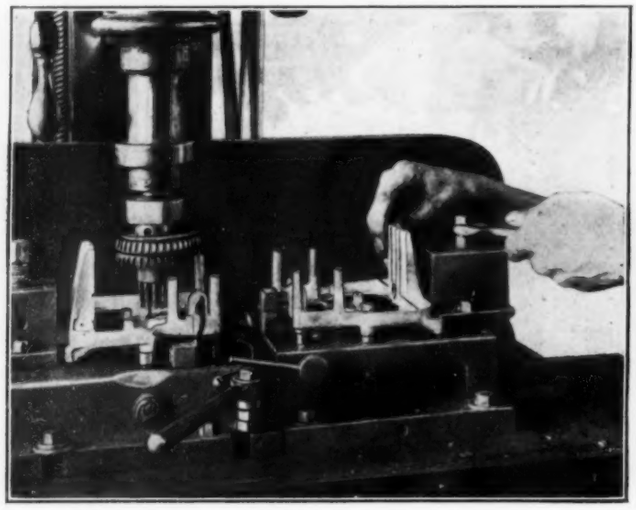


Fig. 11. Milling Type 1 Meter Frames

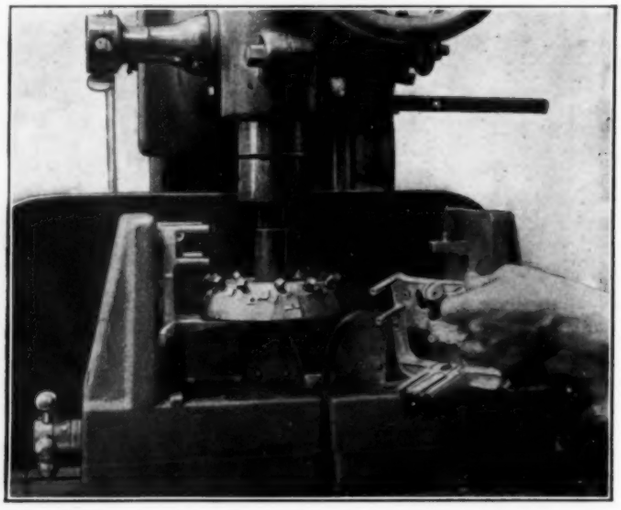


Fig. 12. Milling Magnet Shelf on Meter Frames

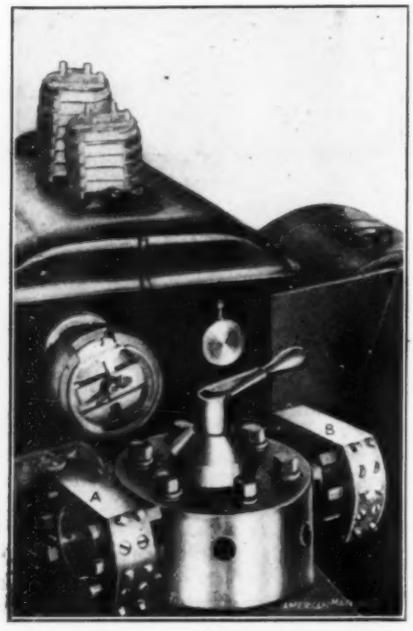


Fig. 10. Turning and Boring Frames

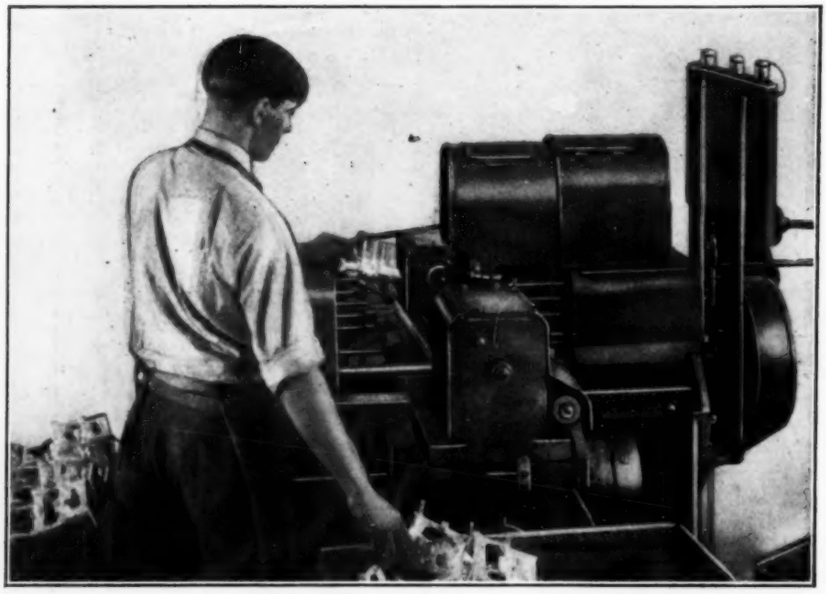


Fig. 13. Drilling Meter Frames

Then the reading of the indicator on the other end is taken against the concave arc, which shows the exact relation of the gap and the bearing surface of the shoe.

This is extremely important, as on this distance depends the correct location of the aluminum disk which must run between the magnet poles.

Testing Magnet Strength

The strength of the magnets is measured by the machine shown in Fig. 7, the measuring being done by a differential meter shown mounted in the center of the testing table. This is in reality two meters, the upper being standard in every way, while the lower meter is connected through the rheostat *R*, shown at the end of the testing bench.

The magnet being tested acts on an aluminum disk which is inclosed in a brass casing for protection, but which is nevertheless, acted on by the magnets the same as in the completed meter.

Magnets are tested by being placed in the position shown, and adjusting the rheostat by means of handwheel *C* until the large graduated disk at *B* becomes stationary. The hub *D* of the wheel *C* is graduated into arbitrary numbers, and the position of the pointer is noted when the adjustment has been made. This number is then marked on the magnet with a colored ink and represents the strength of the magnet as compared with that of the standard.

These magnets then go to the stock room and are sorted according to number, magnets within a certain specified range being used for meters of certain types.

Assembling Magnet Punchings

Having brought the permanent magnets up to the stock room, we can take up the other parts of the instrument, such as the electromagnet shown in Fig. 8.

Fig. 15. Meter-assembling Department

Fig. 16. The Production Department

When we see this with its many laminations and its coils in place, it arouses curiosity as to the methods used in assembling, in order to get the coils *A*, *B* and *C* into place without winding them in position, which we know would hardly be practicable. The explanation of this is found by going back to the assembling processes and seeing how they are put together.

To begin with, the punchings are of an interesting shape, as can be seen from Fig. 9, which shows a pile of the Type I-10 meter coils partly assembled in the jigs, ready for the last punching to be put in place. The jig consists simply of an iron block *A* which holds the coils *B B* in place and into which the skilful operator inserts the punchings, as can be seen.

At the beginning of this assembling it is easy to take several punchings and

Fig. 14. Soldering Fixture for Dials

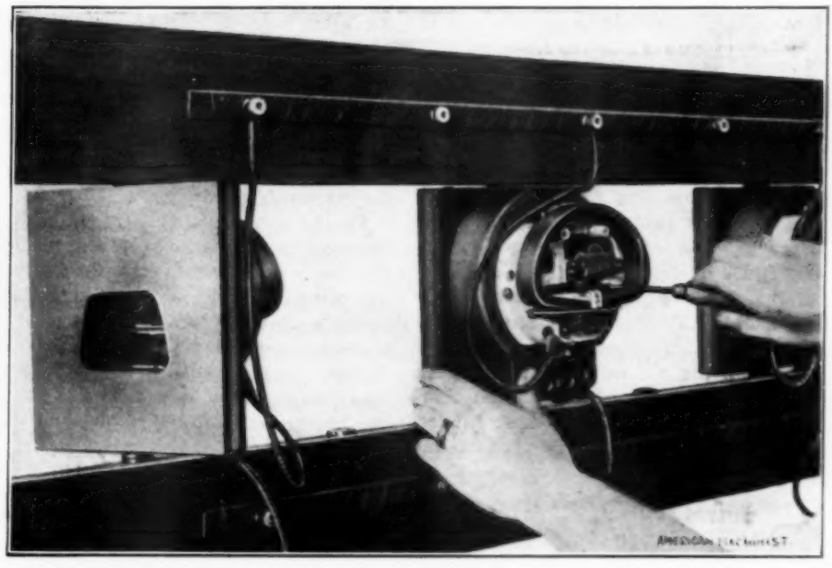


Fig. 17. Test Rack for Adjusting Lag and Lead

thread them into the coils or windings, as shown, but as the work progresses it is necessary to handle them in smaller numbers until toward the last only one at a time can be put into place. But by bending up the outside or frame portion, so as to slide over the outside of the magnet windings, it is very easy to put them all into place as can be seen.

Thimbles or hollow rivets are then put through the holes already punched and riveted over, holding the whole number of laminations in one piece and allowing the gap punchings and bracing or stiffening plate to be put into place before these are brought to the assembling benches, to be put into the meter cases.

Boring Frames for Meters

Fig. 10 shows the method of holding and boring the frames for these. The holding chuck is simply bored out the right size to receive the outside of the frames, while each side is cut away in order to allow room for the projection, the frames being held in place by the strap and thumb nut shown. The roughing and finishing tools are shown at *A* and *B* and consist of a type of hollow mills carrying six tools as can be seen. These turn the outside and bore the inside of the large portion of these frames, as can be seen from those piled on the lathe headstock.

Milling the Meter Frames

Figs. 11 and 12 show the very practical application of continuous milling methods in making the Type I meter frames. This is done on a vertical spindle machine with a gang milling cutter as can be readily seen, the frame at the left being operated on while the one at the right is being adjusted in place. This also shows the style of jig used and the method of locating the frames in them. They are located by trunnions at each end which can be clearly seen in the frame at the right, all the surfaces being located from these points.

Fig. 12 shows the same frame having the shelf milled for supporting the magnet, the same method of continuous milling being used as before. The outer end of the magnet shelf is supported by the anvil block, shown under the milling cutter, the cutter itself being of the inserted-tooth type of large diameter, running at high speed and doing the work almost as fast as an operator can load and remove the frames from the jigs.

Fig. 13 shows a special multiple drilling machine having 25 spindles and drilling the meter frames complete at one operation. The whole machine is automatic except for putting the frames in place and removing them after they are drilled. In the position shown the operator has just placed a drilled frame in the box at his right and is placing a new one on the clamping plate and jig *A*. This is automatically controlled by a cam and so timed as to automatically clamp the piece into place just in advance of the spindles being moved to the work in all directions. The drilling jigs are interesting in several details, all drills being guided and the fact that they drill from five different directions, presents problems that are not usually found. The movements are produced by cam shafts after the manner of automatic screw machines. The construction of this machine is of a novel character and its output per day is extremely large.

Meanwhile the registering mechanisms have been going along, with their fine pinion and gear work, the making of the armature shafts, the jeweled bearings, the aluminum disks and other details. These disks are finished from the sheet, put under the drop to straighten and have a series of small indentations to relieve the skin tension of the metal. These have to be very carefully made as the clearance between the poles of the permanent magnets air gap is not large.

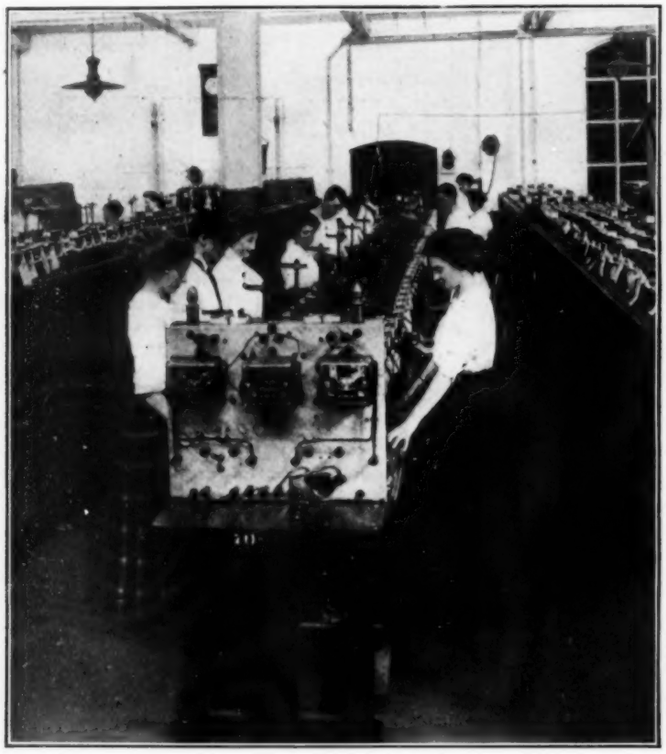


Fig. 18. Testing Type I Meters

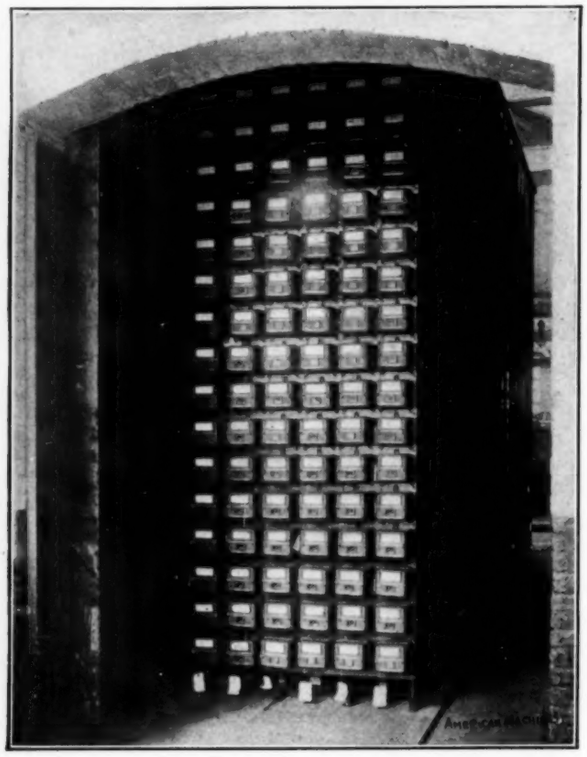


Fig. 19. Meter Storage Room

A Convenient Soldering Iron

One of the most convenient soldering irons imaginable is shown in Fig. 14. Here the copper bit *A* is connected with an electric heating unit so that the proper heat is always maintained, the bit having the edge thinned down so as to make the desired contact with the part to be soldered.

This is used in soldering the porcelain dials onto the frame for the meter and is a case where ordinary blowpipe methods would be extremely difficult on account of unduly heating the porcelain dial. Here the parts to be soldered are simply clamped together, cleaned with acid, and

by being held a few seconds against the edge of the hot copper bit, the solder is uniformly melted and a substantial job is secured without danger of overheating or the uncertainty of not having secured a good joint. In addition to this it is an extremely rapid method.

The Assembling Department

Fig. 16 is given solely to show the general arrangement of the meter production department, the plan being to have the work progress from bench to bench down each side of the central aisle and not crossing this aisle until it comes to the assembling department where they are put together and adjusted before testing. This has been carefully planned out so as to avoid any rehandling or back lash, the work going forward with great regularity and allowing the department to be organized very compactly.

Fig. 15 shows in detail one of these sections down at the further end, where the meter parts have been brought together for assembling. This shows the double magnets in the foreground at the left, meter cases at the right and down the line, the various parts, such as the frames carrying the aluminum disks and the recording devices which may be called the clock-work of the instrument.

Preliminary Testing

Fig. 17 shows a portion of the test rack for adjusting Type I-10 meters for accuracy when used on inductive load circuits. Here the magnet coils which we saw in Fig. 8 have been assembled in the base of the meter and the frame carrying the permanent magnet has been placed in position. The meters are mounted on the pivoted boards shown which allows them to be swung into any position for easy adjustment.

The Final Testing Department

Fig. 18 shows one of the benches in the testing department for meters of this type. The meters being tested are hung on boards which are suspended by wires from the ceiling, while counterweights under the bench keep the wires taut and prevent the vibration of the building from affecting the meters being tested.

At the front of the bench are mounted three meters. The central meter is adjusted especially for testing at light loads, as this is the most delicate part of the work that the meter must perform accurately is of the utmost importance. This meter is connected to the light-load circuit of the testing bench and to ared signal lamp, which can be seen standing vertically in the center of the bench so that it can be easily seen by every tester without moving from his position.

This meter is so adjusted and equipped that it throws in the current to both the red signal lamp and the meters being tested at a given time, runs long enough to turn the aluminum disk in a correct meter exactly one turn and then cuts off the current from both the lamp and the meters being tested.

This enables the operator to turn all the disks on a bank of meters so that the black mark which is painted on the disk solely for testing purposes, stands central while the red lamp is out. She then throws in a mercury switch and goes about her work on the next bank of meters.

At the predetermined time, the master meter switches on the current to both the meters and the signal lamp and again shuts it off as soon as one turn is made. As soon as the lamp goes out she inspects the disks and can see at a glance which are fast and which slow, if any.

For testing at the full loads, the outside meters are used, these being connected by a relay to actuate small plungers which come up through finger plates in the testing bench, these plungers being actuated twice for every revolution of the disk in the master meter. In using these, the operator places her fingers on the plate in the bench over the small plungers and notes the position of the black mark on the disk at every movement of the plunger. This enables her to easily follow the revolutions of the disk and is an easy matter to so adjust the permanent magnet so as to secure the correct speed of the disk.

Meter Storage Room

While there is a remarkably steady demand for electric meters when considered year by year and the increase seems to take place at a fairly steady rate, there are usually high and low points during the year on the curves of demand.

In order to maintain as nearly uniform production as possible, so as to secure all the benefits of a permanent organization, instead of laying off workers during the dull season, and attempting to hire skilled help when the rush comes on, it is the intention of this department to run a steady output per month throughout the year.

This means that during the summer months a large percentage of the meters made must go into stock which will be drawn on in the fall as soon as the days begin to shorten. Fig. 19 shows one of the meter storage racks which are so compact that the section shown holds 4500 meters. Each one is accessible from either side and each one bears the full pedigree of its passage through the testing department, so that it is ready to be sent out as fast as the orders come in. These storage rooms are in fireproof vaults as the amount of money tied up in several thousand of these meters is more than might be imagined.

Sand for Extinguishing Fires

By Irvine Kempt

In the various comments on fires in factories, which are so common, I fail to notice any reference to the efficiency of sand as an entinguisher.

At a fire which occurred in Boston, September 10, in a garage, water was used at the start, whereas, if a few buckets of sand had been properly placed, a most disastrous fire might have been averted.

In three factories where I have been employed, in which alcohol, kerosene and gasolene were in daily use, buckets of sand were kept within easy reach, proving more than once an effective means of smothering that which might have been a serious fire.

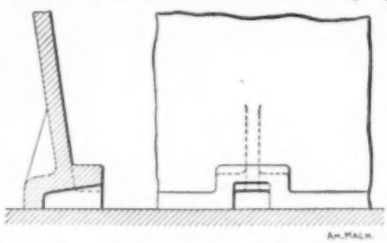
Of course, sand is not desirable among machinery, but it is preferable to total destruction. Factory fires will not be materially decreased till we have more intelligent inspection upon the part of the fire underwriters.

The employment of men who know something of factory life and methods, with the necessary courtesy and firmness to secure the carrying out of their recommendations for the prevention of fire, will be a long step forward.

Crowbar Opening on Machine Tools

By M. Jacker

This is an idea for machine-tool builders. It would be well for these concerns to consider with what ease and dispatch their machines would find their proper



Crowbar Opening on Machine Tools

place on the floor, if they were provided with pinch-bar pockets next to the foundation or floor. These pockets should not be cut through but built around as indicated in the sketch, so that there would be no interference when on rollers.

No arguments, now! I have no patent on this.

Just provide your machines with these air holes and see what praises will come your way from the man with the crowbar.

The total value of all electric lamps manufactured during 1909, according to the recent census, was $15,715,000. This does not include sockets, receptacles, bases, etc., or lighting fixtures of any character.

Tools Used in Building Engine Lathes

By F. A. Stanley

A set of simple milling fixtures for holding headstocks while the different surfaces are machined with gang cutters. Spindle boxes finished by milling a temporary keyway by which the two halves of the box are located on an arbor of unusual form.

Reaming fixtures for headstocks and aprons; a dovetail milling attachment for finishing compound rests in the lathe; a milling fixture for facing bosses on the ends of beds.

The Von Wyck Machine Tool Company, Cincinnati, Ohio, makes extensive use of the miller in machining various lathe parts, such as headstocks, tailstocks, spindle boxes, aprons, etc.; and in the accompanying engravings which represent typical operations in this company's shop, a number of views are devoted to methods of surfacing work under the milling cutter with the aid of suitable fixtures for holding the castings and setting the cutters.

Headstock Fixtures

The halftones, Figs. 1 to 4, inclusive, show a set of fixtures and cutter outfits for milling headstocks. The first operation, Fig. 1, consists in mounting the rough casting in position for the milling of the cap seats, and here the work is located by two conical plugs which are slipped into the holes cored for the back-gear shaft. There are four jack screws under the work and the two outer ones are first adjusted until a straight-edge, placed across the top of the rough headstock housing, just touches the top of the gage *A*. This levels the casting, which has about ⅛ inch extra metal at the top for facing off with the cutter, and then the two inner screws are adjusted under the work so that it is well supported for the cut.

The milling cutters are set to the gage *B*, which gives the right hight for the cap seat and also the lateral position for the lips over which the caps fit.

The conical plugs for locating the headstock in the first place, are threaded so as to be screwed through the walls of the fixture and are provided with long nurled handles, by which they are readily operated.

The Second Operation

After the cap seats are milled, the headstock is placed bottom up on the fixture, Fig. 2, where it is located by the milled seats, as indicated. A gang of six cutters is used for milling the V and flat bearing surface along the bottom of the head, and these cutters are set by the gage *C*. After the work is passed under the cutters it is run back, by hand, with the cutters stationary, and then fed again past the cutters without readjustment of the table, the second cut removing just enough metal for a satisfactory surface.

Milling Box-housings and Bosses

The fixture in Figs. 3 and 4 is for locating the headstock crosswise of the miller table for the straddle milling of the caps and housings, and for surfacing the bosses at the upper end of the head for the reverse tumbler.

The first of these operations is accomplished as in Fig. 3, with four large inserted-tooth face mills, the work being fed vertically to the cutters without longitudinal movement of the table after a central position of the fixture and headstock has been obtained.

The headstock rests on one V and one flat way on the fixture and is located endwise against a stop pin, which also serves as a locating device for the operation in Fig. 4. In this view the fixture is represented as turned end for end to bring the tumbler boss into position for machining with a large facing cutter.

The table is so adjusted for this operation that the boss will be faced a definite distance from the finished end of the seat for the spindle box, and as the headstocks are all set for the two operations

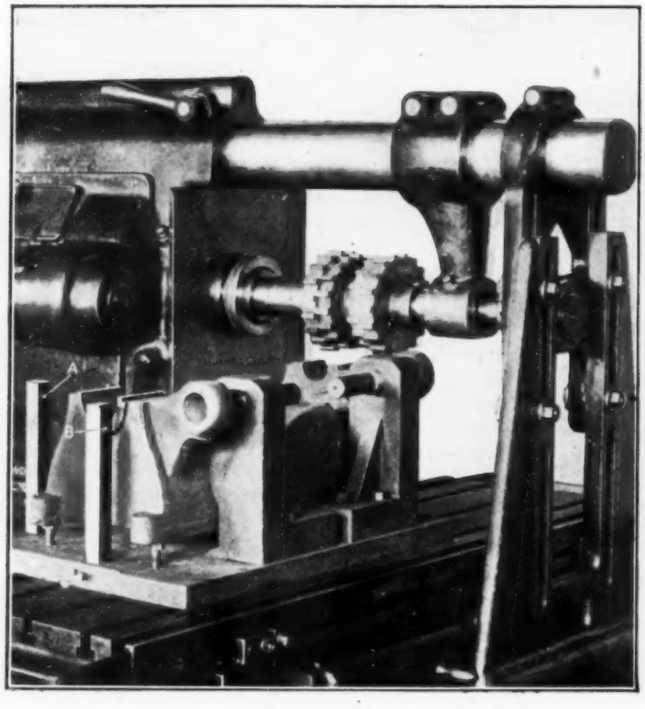


Fig. 1. Milling Cap Seats on Lathe Headstock

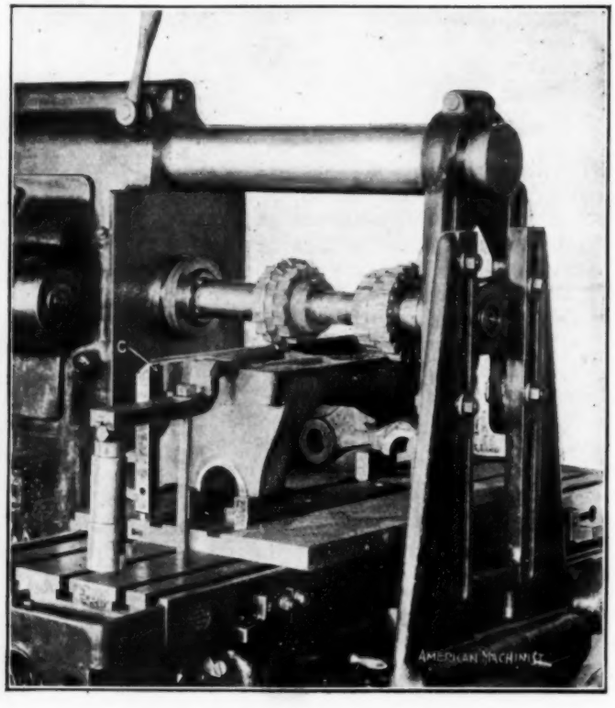


Fig. 2. Milling Bottom of Headstock

to the same stop pin, this distance is maintained in all cases, so that with the rest of the parts made to correct dimensions, the tumbler gears will match up with the spindle gear when the head is assembled.

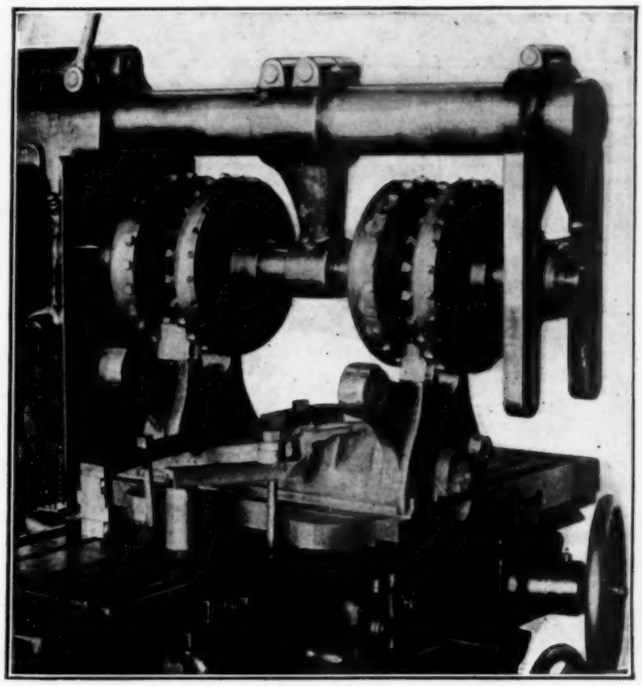


FIG. 3. STRADDLE MILLING HEADSTOCK HOUSINGS AND CAPS

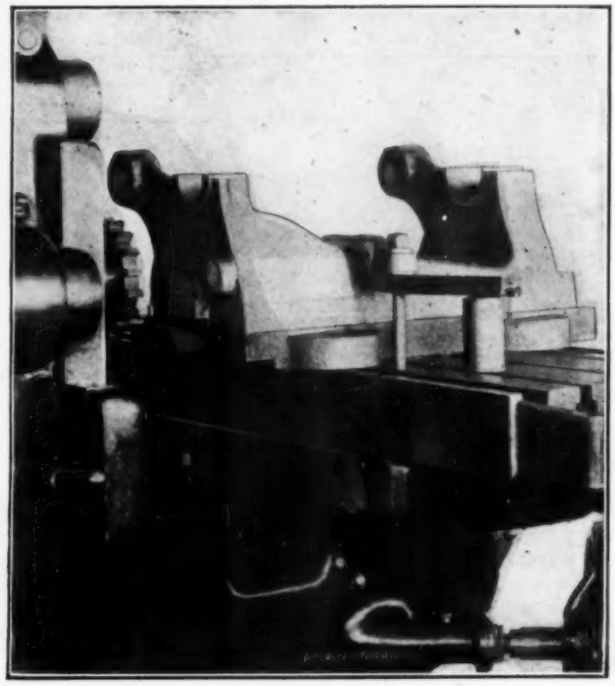


FIG. 4. FACING OFF TUMBLER-PLATE BOSSES

CAPS AND SPINDLE BOXES

The caps are milled, jig drilled and attached to the head, and the latter is then placed on a fixture in the lathe for the boring of the seats to receive the spindle boxes. These are of phosphor bronze, made in halves and machined in a unique manner.

A pair of the box halves with holes cored considerably under size are shown in Fig. 5 on the miller, where the first machining operation is accomplished. This consists in facing the flat joint of the box and milling a half keyway along either edge of the rough bore, as seen more clearly in Fig. 6, which is a detail of the front bearing for a 15-inch lathe, the sketch at the right in this engraving showing the cored box with the keyways milled along the edge, while the other views represent the piece after it is bored to size, an operation that removes the keyways.

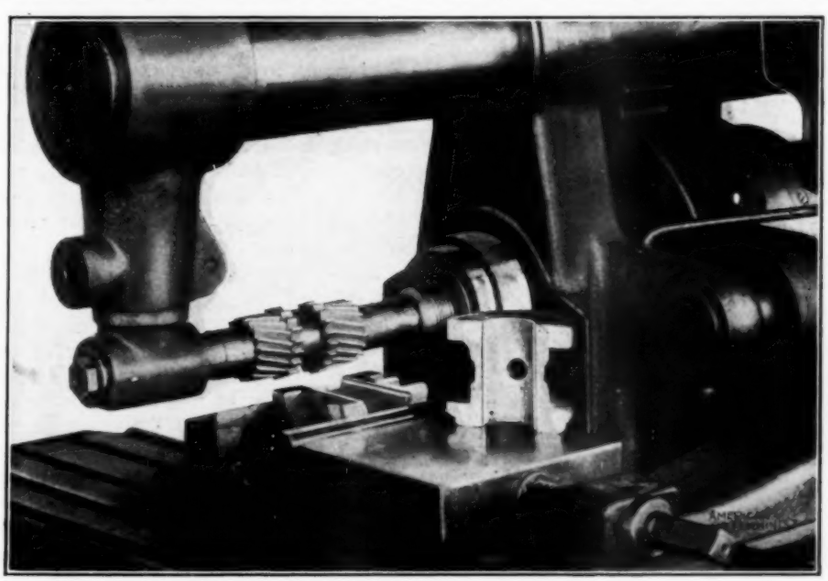


FIG. 5. MILLING SPINDLE BOXES

MACHINING THE BOXES

The object of the half keyways is to provide a means of locating the boxes centrally on an arbor for the machining of the exterior surfaces, so that when they are pressed into the headstock and cap the flat faces of the two half boxes shall be perfectly flush with the faces of the castings in which they are fitted. The arbor upon which this is accomplished is illustrated in Figs. 7 and 8.

This arbor is fitted with two pairs of keys at opposite ends and exactly on the center line, and it is against these keys that the rough boxes are held for the turning and facing operations, the core being fully $\frac{1}{8}$ inch larger than the arbor body. The keyways in the work rest upon the arbor keys, and these keyways are of such depth that when the two halves of the box are secured on the keys the faces of the half boxes are also just in contact with each other. When the outside of the box is turned each half represents an exact half circle.

HOW THE WORK IS HELD

For the turning and facing operations on the flanges of the box, the two large gripping nuts on the arbor are removed and the two half boxes secured to the arbor by a through bolt as at *D*, Fig. 8. The arbor is placed between centers on the lathe where the flanges are turned and faced and the corners rounded. For holding the work for the turning of the body between flanges, the boxes are gripped between the clamp nuts *E E*, which draw the two parts down hard on the centering keys, and as the cross bolt is not required in this operation, that portion of the boxes between the flanges is readily machined by the lathe tool.

BORING AND REAMING

After the boxes are pressed into their seats in the lathe headstock and caps,

the latter are bolted in place and the headstock returned to the boring lathe, where the boxes are bored to within 0.001-inch of size. This small allowance is left for removal in a reaming fixture shown in Fig. 9.

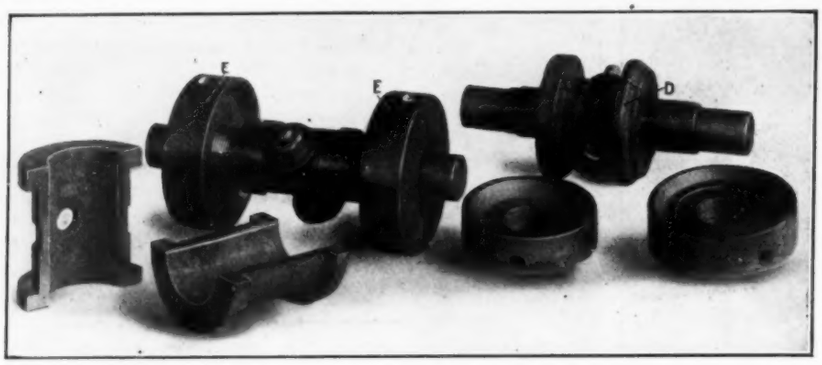


FIG. 8. ARBORS FOR SPINDLE BOXES

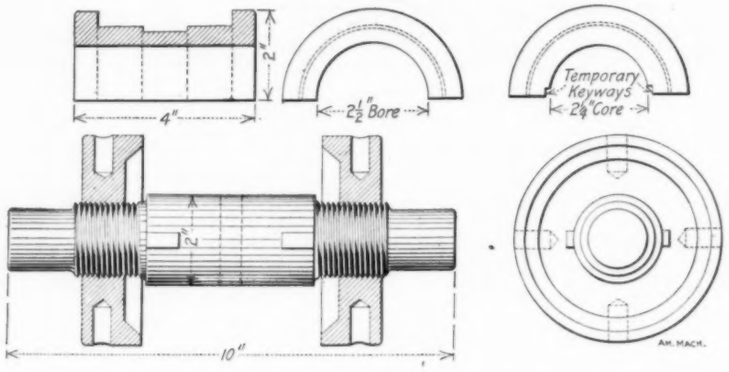
Both boring operations in the head are performed with the work resting upon ways which are duplicates of the lathe-bed shears, and similar ways are provided on the reaming fixture, Fig. 9. A tandem reamer with expansion blades is used here and both ends are guided in long bushings during the process of scraping out the one-thousandths inch of metal left by the boring cutters.

The methods followed as outlined above in preparing the headstock for the erecting floor leave as little work as possible for the attention of the scraper hands during the process of fitting up and alining the head on the lathe.

APRON REAMING AND TAPPING FIXTURE

Another reaming fixture is shown in Fig. 10. This device also provides for a finish tapping operation. The fixture is adapted for receiving a lathe apron and holding it while the bearing bracket for the bevel-feed reversing gears is reamed and the half nut for the lead screw tapped to size.

The bracket is first bored to 1/64 inch of size on an angle plate on the lathe and the feed nut is chased on the lathe to the same allowance for finishing, the nut, of course, being closed for the threading operation. Then the nut and bearing bracket are placed in the apron and the apron clamped in the fixture, Fig. 10, where the reamer and tap are guided by suitable bushings and a correctly sized and alined job secured.



FIGS. 6 AND 7. SPINDLE BOX AND ARBOR

This fixture is mounted in use, on an upright which permits it to be held in any position which may seem most convenient to the workman.

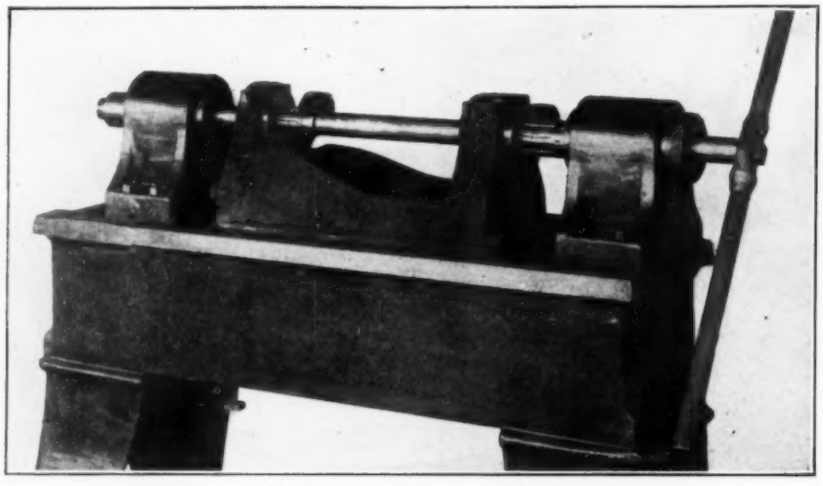


FIG. 9. REAMING FIXTURE FOR HEADSTOCKS

MILLING IN THE LATHE

Compound-rest dovetail guides are machined by a milling fixture fitted to the lathe as in Fig. 11. The fixture has an adjustable member for holding the work and a cutter head with two spindles for carrying a pair of angular cutters which are used as straddle mills.

The casting, as it appears when milled, is shown at *F*, mounted upon the vertical face of a stiff block which is adjusted to the requisite hight by screws *G G*. This adjustment is facilitated by a series of graduations and by pointers at the left side of vertical guide *H* and the corresponding guide at the front end of the fixture.

ORDER OF OPERATIONS

The compound-rest guide is grst faced off on the bottom in a lathe on a faceplate fixture. Then in a miller the top is gang milled to surface the entire upper face, including squaring of the edges of the guide portion itself which is later to be finished to dovetail form. Sometimes, this dovetail section is also roughed out to approximate size by ordinary bevel, shank cutters in the miller before the work is brought to the fixture in the illustration. In either case the fixture in the illustration. In either case the fixture is intended for facing the work accurately and forming the dovetail angles correctly, and its use, though on external surfaces, may be compared say, to that of a reamer which is employed for keeping work to size.

The cutter spindles are geared together and driven by dogging from the faceplate. The lower spindle admits of a slight amount of adjustment toward the upper one in order to compensate for a reasonable amount of wear. This is made possible by permitting the gears to be slightly separated at the pitch line at the outset and drawn together as adjustment becomes necessary.

The results obtained with this method of finishing the dovetail guides and the adjacent flat surfaces have proved very satisfactory and the time required for

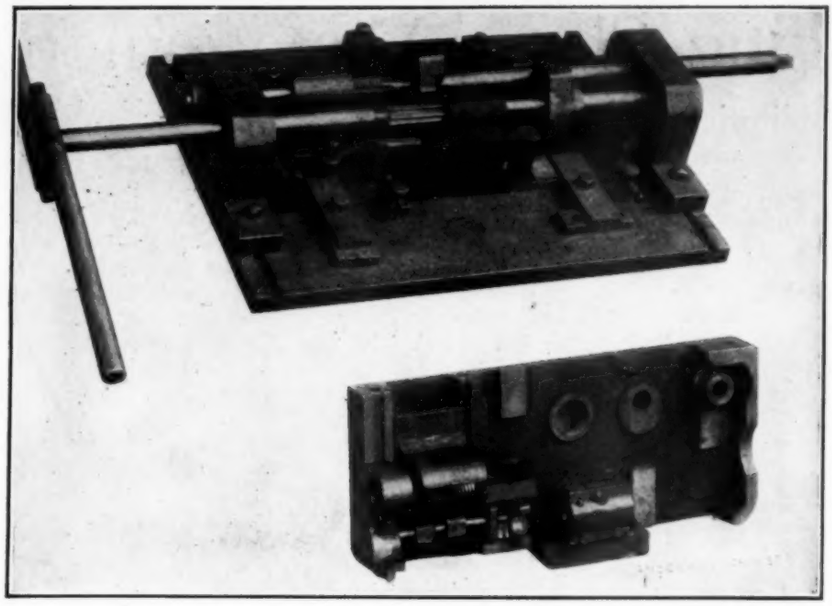


FIG. 10. A TAPPING AND REAMING FIXTURE FOR LATHE APRONS

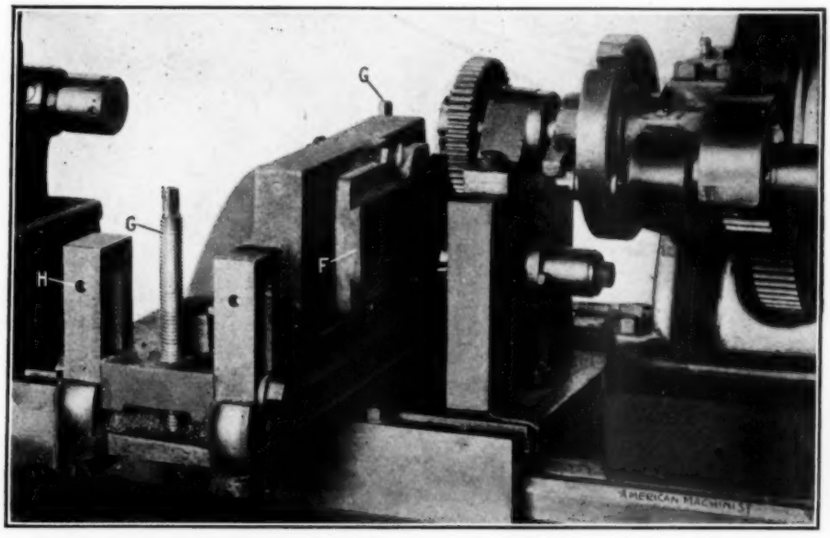


FIG. 11. MILLING ATTACHMENT IN THE LATHE FOR FINISHING COMPOUND RESTS

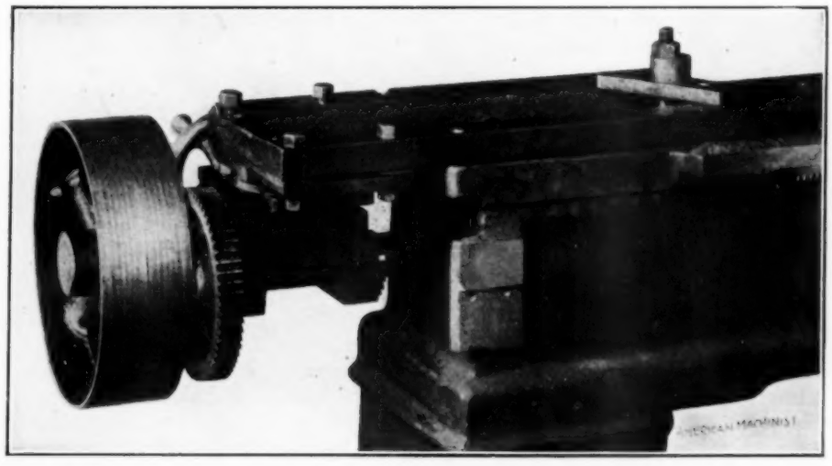


FIG. 12. ATTACHMENT FOR MILLING QUADRANT BOSSES ON LATHE BEDS

scraping and fitting has been cut down very appreciably.

A MILLING ATTACHMENT FOR LATHE BEDS

An attachment is shown in Fig. 12, for milling off the faces of quadrant bosses on the ends of lathe beds. Formerly it was the practice to chip and file this surface, and the difficulty and delay incident to this unsatisfactory process led to the construction of the portable miller which is seen attached to the end of bed.

The appliance is secured to the under side of a base plate which is provided with V and flat bearing surfaces to fit the lathe shears upon which it is strapped. The cutter is mounted on the end of a spindle journaled in a bracket carried by the top slide of a regular compound rest for a lathe carriage. The cutter spindle is driven by gearing from the large pulley which is belted from a testing countershaft. The feed screw for traversing the slide and cutter past the boss in the facing operation is actuated by the handwheel seen at the front of the attachment.

Dowel Hole Repair

BY C. E. PICKARD

Having a number of aluminum crank cases to machine, the top and bottom halves were kept in position by dowel pins. After drilling the holes the pins were slack. I made a simple tool to close the metal onto the pin, the hollow cup compressing around the pin, Fig. 1.

This tool can also be used on the brass spacing plate for ball bearings when a single piece is used. After drilling nearly through the plate, the balls are inserted and the punch closes the open end over the balls.

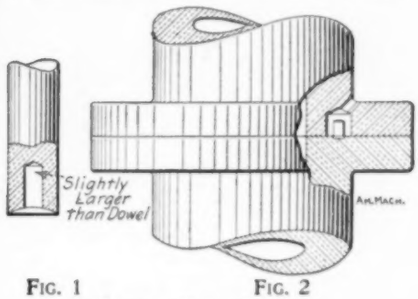


FIG. 1 FIG. 2

DOWEL HOLE REPAIRS

Some old top halves were being fitted to new bottoms, but the dowel pins pulled them out of line. To ease the pins was out of the question, as they had to be a snug fit; hence the recess was drilled out sufficiently large for babbitt. A small hole being drilled into the top of the hole, the cases were fixed in proper position and the metal run in. A firm job resulted, Fig. 2.

The less jar there is about the running of a wood-turning lathe, the better it will do the work; the machine will last longer and the manager will keep his temper better.

Canadian Pacific Shop Management

Editorial Correspondence

The shops of the Canadian Pacific Railway have been referred to repeatedly in newspaper reports as shining examples of scientific management in such a way as to lead one to the belief that they had been given over entirely to one of the iron-clad systems which are endeavoring to appropriate that name. As a matter of fact, nothing of the kind has been done, although Mr. Vaughan and his assistants give credit cheerfully to H. L. Gantt, who has acted in an advisory capacity for some time, for the assistance that he has rendered in improving conditions in general.

A careful and conscientious attempt has been made to thoroughly study all the conditions entering into the production of work in a shop of this kind, and, in addition to the many labor-saving devices which have been introduced, they have a very careful system of setting piece-work prices and of keeping track of the work as it goes through the shop. While they are handicapped to some extent with machinery which is not modern either in design or production, this is gradually being eliminated and modern machines are being installed from time to time.

Setting time limits by special slide rules, which take into account machine efficiency, hardness of metal and allow for handling work.

A plan to credit men with both the skill used and muscular effort expended in performing different classes of work.

Fig. 2 shows a slide rule which has been devised for turning and boring on lathes and boring mills. As will be seen, this is complete in itself for both steel and cast iron by the use of the two sets of curves, shown at the left of the lower slide. This also takes into account the depth of the cut, the size of the tool, whether the work is turned or bored dry or wet, and makes the allowance of 10 per cent. to time, and 20 per cent. in handling time. This makes it a very complete slide rule for this purpose.

Instruction Cards

Instruction cards are made in considerable detail, as will be seen from the one reproduced in Fig. 1. Zinc reproductions of drawings are used in the blank space shown on the front of the card, so that there may be no mistake as to the piece in question, but the men are particularly cautioned, as will be seen, against using any dimensions that may be on them, and are referred to standard drawings in all cases. On some of the more complicated work a double instruction card is necessary, in which case they are folded so as to go in the same file with the others which are 4x6 inches.

Fig. 4 shows a blank which is a request for a piece-work price by a foreman or one of the men, giving the essential details of the work, and the operation to be performed, while the other side shows, under the heading of Schedule Proof, how the piece price has been determined by those who have this work in charge. Before this is finally settled on it is submitted to the foreman, who goes over the various operations, and if the schedule meets with his approval he attaches his signature to it.

CANADIAN PACIFIC RAILWAY COMPANY
INSTRUCTION CARD LIST No.

Drawing No.
Name
Class
Schedule No.
Issue
Operation
Operation No. Material
No. of Pieces
Time Man-Hours Per
No. of Men
Pay Equivalent For
Each Piece Hrs.
Date

NOTE:—DO NOT USE DIMENSIONS ON SKETCH
USE STANDARD DRAWING

DETAILED INSTRUCTIONS—(Continued) Minutes

TOTAL MINUTES
TOTAL HOURS PER PIECE

FIG. 1. FRONT AND BACK OF AN INSTRUCTION CARD FOR WORK TO BE DONE

The shops are in charge of H. Osborne, while the matter of increasing efficiency, setting piece rates, etc., is in charge of W. B. Hood, who has a number of interesting methods which he uses in this connection.

Working in conjunction with Mr. Gantt, Mr. Hood has devised a slide rule for determining the theoretical time which should be required on a job and which takes into account many of the variable quantities which are not always considered. Instead of making a rule to fit each machine, these have been so designed that two rules cover almost any machine in the shop. These are of two types, one of which includes the efficiency of a machine, which is determined by a table prepared for this purpose.

The second slide rule, designed along similar lines, and shown in Fig. 3, is for planer work.

The slide rule made for the planers has the two slides, which secure all the necessary data, such as the length of stroke in feet, the feed in inches, and width of machined surface in inches, the required time being shown by the lower stationary scale, which runs from one minute to five hours. It will also be noted that the feed is given both in hundredths and in ordinary fractions, so as to be easily read without mental calculation in translating from one to the other. The whole rule is about 12 inches long and 3 inches wide, and can be very conveniently handled either at the desk or in the shop.

It is to his interest to see that the schedules are right, as an incorrect time allowance or rating counts against his department.

Increased Earnings Based on Kind of Work Done

In addition to all the usual details, Mr. Hood has made a very careful study of the question of remuneration, and has gone further in this respect than is done in most cases. Fig. 5 shows what he terms his percentage chart, which, as will be seen, takes into account not only the operative skill, but the muscular effort required to seure a large output.

After determining the theoretical time in which work can be performed in the making of instruction cards, an allow-

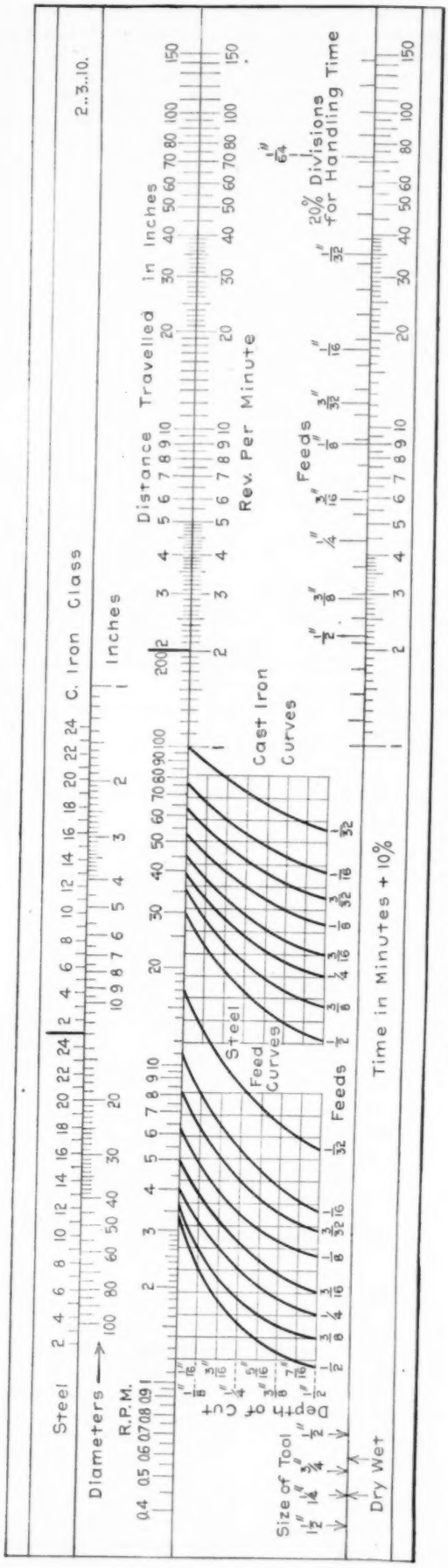


FIG. 2. GANTT-HOOD SLIDE RULE FOR LATHES AND BORING MILLS

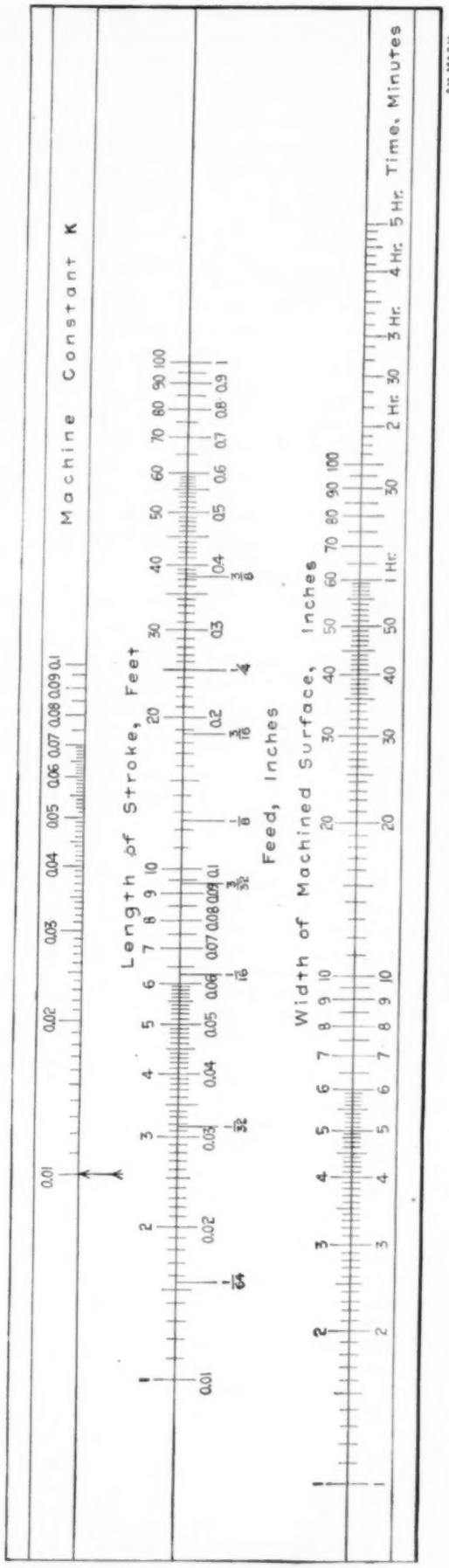


FIG. 3. GANTT-HOOD SLIDE RULE FOR PLANERS

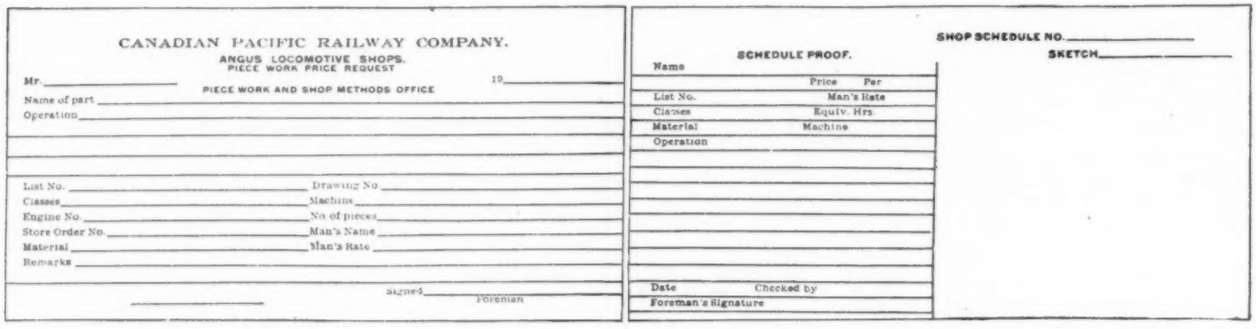
ance of 10 per cent. is made on calculated machine time, and of 20 per cent. on the handling time, in order to allow for occasional hard castings and unavoidable delays which come up in all classes of work. Experience has shown these percentages to be necessary to make the theoretical times work out satisfactorily in practice.

One of the last charts are reproduced herewith, which have been in use for some time, and seem to be giving entire satisfaction.

How It Works

The question might arise, how is the skill in the operation taken care of? In most cases of the work done in railway shops, and, for that matter, in almost any other class of machine work, the amount of skill and close application required increases proportionately with the number of operations per hour. As an example of this, Mr. Hood cites the case when a cylinder bushing is being turned and bored on a boring mill, as compared with the turning of a small motion pin on a lathe. The percentage in the case of the cylinder bushing is 25 per cent., and on the latter between 40 per cent. and 60 per cent., depending on the dimensions of the motion pin.

Taking the example shown in chart No. 1 of turning and boring, we find 15 as the minimum operations per hour, and that if this number of operations fails to finish a piece in an hour, as shown by the lower diagonal line, there is an increase of 26½ per cent. If, however, the same number of operations complete five pieces per hour, the increase is 36½ per cent. In this case the workman has performed no more operations, but he has handled a piece of work every 12 minutes, and his increased percentage is a reward for the muscular effort required to do this work. He would secure practically the same increase from handling only one piece per hour, providing that piece required 29 different operations.



CANADIAN PACIFIC RAILWAY COMPANY.
ANGUS LOCOMOTIVE SHOPS.
PIECE WORK PRICE REQUEST

Mr. _____ 19____

PIECE WORK AND SHOP METHODS OFFICE

Name of part _____
Operation _____

List No. _____ Drawing No. _____
Classes _____ Machine _____
Engine No. _____ No. of pieces _____
Store Order No. _____ Man's Name _____
Material _____ Man's Rate _____
Remarks _____

Signed _____
Foreman

SHOP SCHEDULE NO. _____

SCHEDULE PROOF. SKETCH _____

Name _____

	Price	Per
List No.	Man's Rate	
Classes	Equiv. Hrs.	
Material	Machine	
Operation		

Date Checked by
Foreman's Signature

FIG. 4. FRONT AND BACK OF REQUEST FOR PIECE RATE

Allowing for Extra Pay

In adding the required amount for the performance of the work, they first adopted the usual allowance of a flat 25 per cent. increase in earnings, which it was expected a good man would make over day wages. But as has been found in almost every shop, this did not prove entirely satisfactory in all cases, and a closer analysis of the subject indicated that each class of work should be treated differently.

As it was extremely difficult to vary this percentage according to individual judgment, owing to difference of opinion between shop instructors or demonstrators, the men and the management, it was decided to study the question so that a rule could be formulated which could be adhered to and be satisfactory to all concerned. A careful study was then made of a number of the different shop operations on the various classes of machine, and agreements reached as to what would be the proper percentage to allow over and above the required time for the performance of the work.

The two variables on which this depended to the largest extent were the number of operations the mechanic performs per hour, and the number of pieces that are loaded and unloaded, or handled, on the machine at the same time. Having decided on the correct percentages for several cases, it was not a difficult matter to plot or chart to suit the percentage when the number of operations and the number of pieces per hour could be taken from the records.

The first set of charts made were naturally not quite satisfactory, and after a few weeks they were altered, so as to give a higher percentage for an increase in the variable quantities in most cases.

While it is not claimed that these charts are by any means perfect, they are commendable as being an earnest attempt to fairly solve a problem which has been ignored in many cases, or left to take care of itself in many others.

Considering the Hardness of Metals

One of the important features in all machine work is the relative hardness of metals, or to be more correct, their resistance to cutting, or "cutability," if such a word may be used. That this phase has not been overlooked is indicated by the reproduction from various blueprints from a page of the inspector's notebook, which is shown herewith.

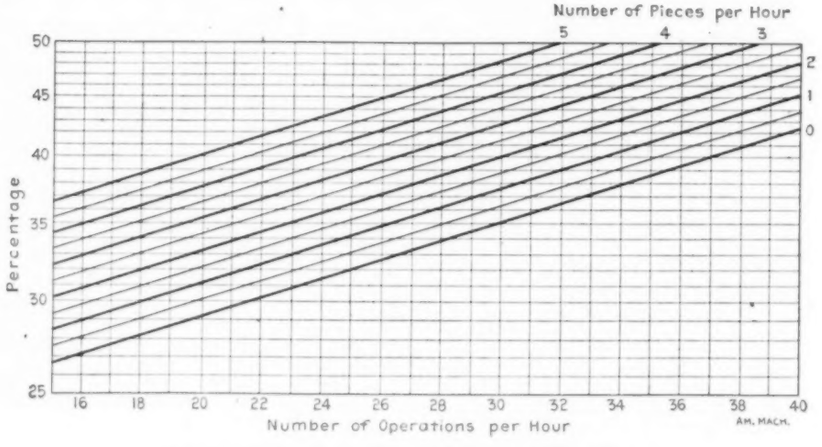


FIG. 5. INCREASE OF DAY RATE FOR GOOD WORK

CLASSIFICATION OF METALS
FOR HARDNESS AND CUTTING SPEED

No. 10 Crank pin (hammered iron).
No. 11 Piston rod (hammered iron).
No. 12 Dome covers (steel plate).
No. 12 Driving axles (steel except Krupp).
No. 17 Old truck tires (Krupp steel).
No. 19 Driving wheel centers (cast steel) (in scale).
No. 19 Eccentric straps (cast iron).

NOTE—To be used in connection with the slide rule, for lathes and boring mills, for the determination of the efficiency of roughing cuts. The greatest feed that can be taken with a given depth of cut and cutting speed that will cause the edge of the tool to be ruined to the extent of necessitating regrinding at the end of a continuous cut of 20 minutes' duration, determining the class of the metal, for hardness and cutting speed. The class of any metal may be arrived at by using the above mentioned variables in conjunction with the size of the tool, wet or dry, and the diameter of the work, applying the same to the slide rule, in a manner opposite to that usually employed.

T = Total time for planing piece.
t_c = Cutting time per stroke in minutes.
t_r = Returning time per stroke in minutes.
t = Total time per stroke in minutes.
S = Cutting speed in feet per minute.
S_r = Returning speed in feet per minute.

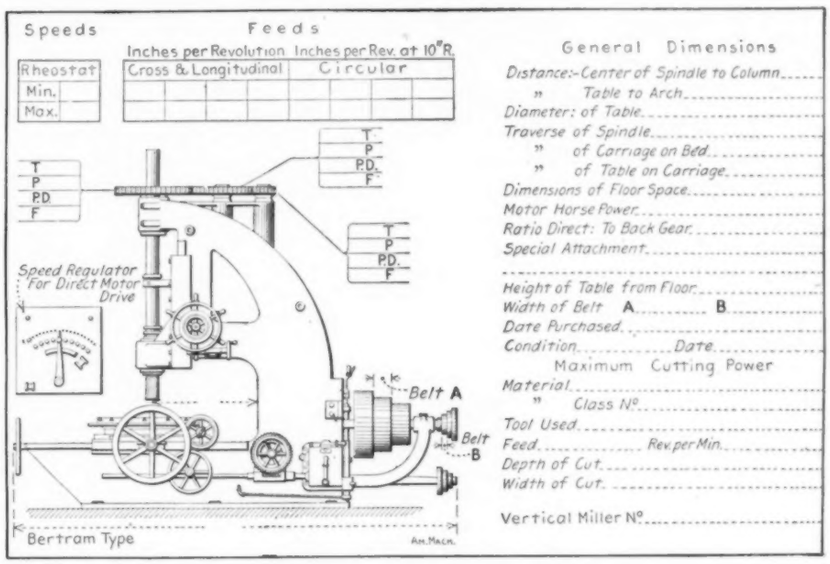


FIG. 6. DIAGRAM FOR RECORDING MACHINE DATA

ANALYZING CAPACITY OF MACHINES

As will be seen from the upper line on the slide rule, shown in Fig. 2, the first consideration is the machine constant, which enables a single slide rule to be used for the various machines of this type in the shop, in place of requiring a separate and special rule for each machine. In order to do this, as well as to know at the same time the exact conditions of the various machines, a large number of them have been analyzed, one being shown in the diagram shown in Fig. 6.

Diagrams of this kind have been made for machines of various types and these blueprints allow all the principal dimensions and essential data to be inserted, both for the purpose of records, of determining what work can be done on dicerent machines, and of securing as far as possible the best work from each machine in the shop. From the information secured in this way the machine constant is worked out so that the time required for various machine work can be readily estimated by the use of the slide rule shown.

GETTING THE CONSTANT "K"

The constant, "K" for planers running at constant speed is derived as follows:

R = Ratio of returning to cutting speed $= \frac{S_r}{S}$.

R = Ratio of returning time to cutting time $= \frac{t_r}{t_c}$.

L = Length of stroke in feet.
W = Width of machined surface in inches.
F = Feed in inches per stroke.

$$t = t_c + t_r = \frac{L}{S} + \frac{L}{S_r};$$

but

$$S_r = RS;$$

therefore,

$$t = L\left(\frac{1}{S} + \frac{1}{RS}\right) = \frac{L}{S}\left(1 + \frac{1}{R}\right) =$$

$$\frac{L}{SR}(R + 1).$$

Now,

$$T = \frac{Wt}{F};$$

and substituting for t its equivalent, $\frac{L}{SR}(R + 1)$ we get

$$T = \frac{WL}{F} \times \left(\frac{R + 1}{RS}\right),$$

for all planers at constant speed.

But, $\frac{R + 1}{RS}$ is a constant, K;

that is,

$$K = \frac{R + 1}{RS};$$

and

$$T = \frac{WLK}{F}.$$

In order to show how this works out in actual practice, let us assume for a particular planer that:

S = 30 feet.
S_r = 90 feet.
L = 3 feet.
W = 18 inches.
F = ¼ inch.

Then

$$R = \frac{S_r}{S} = \frac{90}{30} = 3;$$

and the constant for the given planer is,

$$K = \frac{R + 1}{RS} = \frac{3 + 1}{3 \times 30} = \frac{4}{90}.$$

Now,

$$T = \frac{WLK}{F} = \frac{18 \times 3 \times 4}{\frac{1}{4} \times 90} = 9.6 \text{ minutes.}$$

Preventing Injury to Punch Press Employees

BY F. O. GREEN

Many factories in all parts of the world are constantly paying damages for injury to workmen, most of which could be easily avoided if the same amount were paid toward equipping machinery with safety devices. As a punch-press operator I am particularly interested in this subject, and I am free to admit that every one of us is in constant fear of being caught and having arms and hands mutilated, so that we will be unable to earn our living at our trade. Many punch-press men will deny that they have this fear, but way down in their hearts the "fear of getting caught" is always present.

I would suggest as a positive means against accidents of this kind the doing away with the foot pedal on the press and having it started by the same hand which places the material in the dies. This would make it necessary for the operator to remove his hand out of danger before the machine could be started.

SLOWER WORK BUT ABSOLUTE SAFETY

Of course objections would be raised at once that it would be impossible to operate the machine as rapidly under these conditions as at present. This is quite true, but it might be cheaper in the end to decrease the production slightly, than to run the risk of maiming operators, and paying them damages which are sure to be more and more as the years go by.

The only way to thoroughly appreciate this is to run a punch press yourself, and if that were done I am very sure many shop managers would be very willing to use any safety appliance which would be effective even if the output was somewhat decreased.

The Problem of a Typewriter Works*

By John Calder†

The complex manufacturing problem of the Remington typewriter works, and the scheme of organization that solves it.

Nearly 100,000 typewriters are produced each year, requiring approximately 1,000,000 separate pieces per day, including spare parts. An organization divided into 20 departments handles this work.

A brief statement is here given of a particular administrative problem involving the economical handling of the labor of 2500 people, of whom 500 are females, the production of about 100,000 typewriting machines a year, and a considerable number of spare parts.

The machines contain about 2500 highly finished individual pieces, each of which passes through from six to thirty machining and other manufacturing operations, and many trades and handicrafts are required for the production.

Operations on the typewriter began with the pig iron, on its packing box with the log and practically all of the unit parts are originated within the plant.

A total of about 1,000,000 interchangeable metal pieces of several thousand varieties must be produced daily and an equivalent number of parts be built each day into the different models and lengths of writing line of the Remington standard typewriter, its tabulator and its adding and subtracting attachment.

A machine may be built to write in any one of 84 distinct languages and its keyboard, literary, commercial or technical, may be any one of 500 already registered, or it may be altogether special.

Orders for the Remington typewriter reach the works from every part of the world and only a small portion of the demand can be anticipated by stocking finished machine product.

A rush order for any standard machine not in stock should be shipped by express, without interruption of the regular flow of work, in not more than 48 hours after its receipt.

The requirements outlined demand a very special method. Time study and division of labor are necessary in the preparatory, machining, parts assembly, and machine-building departments, and all the conditions must be met with economy as well as accuracy and dispatch.

The economic problem expressed in a sentence is to produce daily the full quantity of satisfactory machines in all the required varities by the most efficient shop and labor arrangements and with a minimum of fixed and cash capital locked up in the process.

An organization and a system of management which will accomplish this and continue to do so with harmony and satisfaction to employer and employee alike is the desired end.

A Solution of the Problem

For the past eight years the problem just stated has been met by the organization charted in Table 1. Except in that every arrangement of functions has been based on business facts, not preconceived fancies, and on careful analysis, no "scientific" claim is advanced for the system, which is modified in its details as often as desirable.

1. Manager (2500 employees)	2. Executive Departments (363 employees)	4. Customers' orders and shipping (42 employees)	Correspondence on orders	
			Stock of finished machines, packing room	
			Shipping and billing machines and parts	
		5. Purchasing and stores (34 employees)	Purchasing raw material and supplies	
			Receiving clerk, teams, railroad siding	
			Raw material and supply stores	
		6. Finished parts and production orders (18 employees)	Finished-parts stock room, simple and compound	
			Issues all production orders for parts and material	
			Issues all parts for machine manufacture	
		7. Works engineering (90 employees)	Light, heat power, accident prevention	
			Millwrights, electricians, plumbers	
			Fire corps, watchmen, yard labor	
		8. Designing and tool engineering (106 employees)	Inventing, model making, specifications, catalog	
			Designing parts and jigs, toolmaking	
		9. Inspection (35 employees)	Materials, work in process and finished, new tools	
		10. Accounting, labor and motion study (20 employees)	Cashier and bookkeeping	Works "Bulletin"
			Costing and inventories	Suggestion system
			Industrial betterments	Foremen's club house
			Time records and pay roll	Works band
			Rate and method testing	First aid
	3. Manufacturing Departments Superintendent (2137 employees)	11. Manufacture of parts Assistant superintendent and foremen (1653 employees)	Pattern shop	
			Brass foundry	
			Iron foundry	
			Japanning	
			Tinsmith	
			Drop forging	
			Punch and press work	
			Automatic and hand screw	
			Annealing and hardening	
			General grinding	
			Light drilling and milling	
			Cast-iron drilling and milling	
			Polishing	
			Plating and buffing	
			Wood and rubber working	
			Typemaking	
			Assembling compound parts	
			Tool maintenance	
		12. Manufacture of machines Assistant superintendent and foremen (484 employees)	Assembling machine-frame group	
			Assembling machine type-bar group	
			Assembling machine-carriage group	
			Assembling, final stage	
			Adding special features	
			Rebuilding machines	
			School of repairing	

TABLE 1. ORGANIZATION CHART OF REMINGTON TYPEWRITER WORKS

*Excerpt of address given before the Altoona Engineering Club.
†Manager, Remington Typewriter Works.

A summary of the system expressed on the chart is now given, but no forms are illustrated as only principles and broad outline are dealt with.

The organization is indicated on the chart by the numbered and grouped functions which the various assistants control. The figures below each division on the chart indicate the total number of employees engaged in that section and afford, by comparison, some idea of the relation under the system of direct labor upon the product of the various preliminary and operating services found necessary.

A manager (1) is in control of the whole works. He exercises this supervision directly (2) over all the seven executive departments (4 to 10) with an engineer specializing in the same at the head of each.

A superintendent (3) acting under the manager, controls the separate factories, for parts and machines respectively, through the two assistants and the foremen (11 and 12) who supervise the 25 manufacturing shops.

The customer's order department (4) handles all such correspondence, issues all production orders for the building of machines, either stock or special, to the machine assembly factory (12), packs and stores the finished machines on perpetual inventory and ships and bills them and all other products sold.

The purchasing department (5) buys all material and supplies on the specifications of the works and designing engineers (7 and 8). It will be noted that with the function of purchasing is combined that of receiving and storing upon perpetual inventory. I have found this combination economical.

The purchasing engineer has not only to order the goods advantageously and in time, but has also to secure prompt delivery, verification and safe storage, and on demand from the production order department (6) he has at all times the undivided responsibility for "producing the goods."

The production order department (6) controls all work demanded from the eighteen shops (11) producing finished parts and delivering them to its stock room.

This department runs, almost automatically, seven-tenths of the plant on a perpetual inventory basis. The flow of work in every shop and at every stage in each shop and the quantity of every finished part of some 5000 varieties in the stock room is on record at all times, both in the departments and in the stock-room office.

The clerks in every shop report direct to the production order chief. They receive *for* the foremen the order to produce the routine and the material, and get *from* the foremen and inspectors the certified finished work, for record and for storage, or for passing on to another process or department. The production order department's ordering and controlling operations are based upon its finished stock perpetual-inventory figures for each of the parts carried and on data for which the manager is responsible.

Planning—I do not favor the running of shops such as those here described, or indeed any class of manufactures, by fiat in every detail from a central planning department. Attractive as a general scheme, the complete centralization of the initiative and thinking of a plant is neither "scientific," economical nor practical. If attempted, to square with some theory, it undoubtedly slows up the plant and lessens the internal "good will," a most valuable asset.

In the works system here described each section of the organization in conference with the manager and superintendents has its appropriate part in planning and complete records of the same are readily accessible.

The works engineer (7) plans for all power and plant general services, including safety precautions and all maintenance of buildings and machinery.

The design engineer (8) plans for invention, model making, part design, part tooling and toolmaking and the preparation and revision of the catalog of parts which is identical for sales and shop use.

In this connection a simple grouping in tens of thousands up to 99,000 has been adopted, which reveals the group by inspection and a simple or compound part by even or odd ten thousands, for the many parts listed, and leaves ample room for additions in each group. I have found that symbolic or mnemonic systems of nomenclature, while sometimes useful in accounting, are usually undesirable and unnecessary in the shops and can be replaced by simpler numbering methods.

The engineer (8), foremen (11 and 12) and motion-study department (10) plan for and test machine tools, small tools, shop routine and speedy operation and assembly methods, all of which when approved are standard till modified.

The inspection department (9) plans for, executes and reports to the manager on inspections for quality of the raw material, and at the prescribed stages of new tools, parts and new machines. They also report on all missing and spoiled work, assigning responsibility whenever possible and the cash value of the losses. The prescribed inspection tests are standing orders until modified.

The manager (1) in conjunction with the production order department (6) and taking account of the shop capacity for every part and present and forecasted trade conditions, plans for:

(1) A daily "flow" of certain standard parts which is a standing order until modified.

(2) The quantity "to order" and "to stock" of every other part manufactured, also a standing order when fixed.

(3) In conjunction with the customers' order department (4) the manager also determines daily the number and varieties of typewriting machines which are to be built from the parts in "stock" and in "flow."

(4) In conjunction with the purchasing engineer the manager executes all contracts for material and controls the amount of capital tied up in stores.

The second items listed, viz: The "quantity to order" and "to stock" of over 5000 different pieces are the most important of all the figures requiring to be planned. They are practically an epitome of the shop's ability to produce in every respect. They are used with confidence on every occasion by the production order department and control what is by far the largest part of the pay-roll expenditure.

For every part, maximum and minimum finished stock figures are established. These figures are based upon a careful analysis of the time of "flow" of the part from start to finish and on existing trade conditions. "The quantity to order" is so fixed that, if the order is placed when the perpetual inventory shows the "normal" figure in stock, the first portion of the new order will be coming into the stock room before the minimum is reached. The same regulation is adopted for all stocks of raw material and of finished machines.

The fixed capital investment in buildings, machinery and jigs is used intensively and does not permit of assistance by heavy stocking.

In times either of inflated or depressed business the scale on which material is purchased, or parts and machines manufactured is at once modified by the management by suitably altering the permissible maxima and minima and the quantity to order for every item.

The governing consideration of the system is: Sufficient production with minimum investment of fixed and cash capital.

The general result of the coöperative system described is that all preliminary and basic figuring is carried out by the practical experts and departments best fitted to do so either singly or in conference and unnecessary intermediaries are dispensed with.

The results are fully recorded and subject to criticism and suggestion from any source. The production-order and stock-room force (18) is small for an organization of 2500 people and there is no intervening army of clerks, nominally doing this work, but actually merely manipulating card records for the data on which, and the interpretation thereof, others with technical or practical experience are, or should be, responsible.

The Foremen

The work being wholly of a repetition nature, though to limit the investment it is not processed in every particular every day, the foremen are not functionalized out of existence as proposed in some systems and made to feel that they count for little in the general scheme of things.

Relieved of all clerical duties and, because of the motion studies and straight piece work based upon them, of practically all policing duties, the foremen are left free to manage their own shops and to make the most of—if possible to suggest improvements upon—the equipment and instructions given them.

Under these conditions they prove to be the most valuable employees on the pay roll and the most fruitful in good suggestions. Busy foremen are not able to carry out with the necessary detail and thoroughness the preliminary rate and method tests required by the system; if these were left to the shops, progress would be much slower, but they are keen critics of the results when presented for application and not seldom are able to "go one better."

The Accounting, Labor and Motion Study

This is the last executive group to receive special mention here. Just as the plant production is normally run by the production-order department, its methods of operating, its rates and its apparatus for every single part have to be certified in all cases by the rate and method testing division before production on any scale is authorized in the shops.

This small group of independent experts are an essential part of the rating and method planning system and the thoroughness of their work is the justification for a simple straightforward piece-rate system of payment in which the exceptional worker retains his surplus and is not asked to share it with his employer in any form as is done in systems where the rating is largely guesswork.

Briefly stated the designing engineer (8) having previously consulted all the foremen and experts interested, turns over his jigs and tools and proposed shop routing for any new part for criticism, motion, speed and fatigue studies. These are carried out by the testing experts of the accounting department rapidly and with precision and, subject to acceptance by inspectors, practically the whole direct labor of the plant operates under some 20,000 straight piece rates. Some account of the methods and results of tests is given in the appendix to this paper. The division of labor and motion study results are such that workers properly selected and trained make good wages in all departments, while furnishing product at a satisfactory labor cost.

Costing

It follows from the system of payment applying to a large proportion of the employees that, in addition to the day-work accounting on plant maintenance and betterments, the determining of the direct cost of a very varied product is a simple matter. It is needless to maintain a clerical staff large enough to cost every recurring order for each part. Mass costing is found on this system to be more accurate than that carried out continuously in great detail, but the time and quantity cards are accumulated for every order and every part is costed by selection at intervals.

Every standard unit cost is, of course, modified when new methods permit of cost reductions and the operating expense is very closely recorded and studied. The perpetual inventories in quantity of material and parts in process and finished, already mentioned, are represented in the accounting department by similar cash values. The books of the plant are closed monthly and a full statement of balances, of finished product, costs and of profit and loss is issued early in the succeeding month.

Industrial Betterments

In concluding this description of a system which solves the administration problems of the Remington Typewriter Works some reference may be made to several social features.

The *Works Bulletin,* a monthly periodical edited by the manager, is issued to the foremen and assistants with news likely to interest and encourage them, with judicious criticism or appreciation of departmental performances and with full acknowledgment and a detailed list of all the "Good Suggestions" adopted during the previous month and the names of the contributing foremen. Much rivalry is aroused and each issue contains 50 to 150 accepted suggestions of considerable value. In advancing a foreman his record in this respect is considered in addition to executive ability.

A suggestion system separate from that of the foremen is conducted for employees and a prize of not less than $20 in gold is awarded for each accepted suggestion or group of suggestions.

The ordinary employees are not nearly so fruitful in suggestions of value as the foremen, but the door for them is kept wide open and all necessary privacy for this purpose is afforded.

Among other industrial betterments arising out of an atmosphere of good feeling are a library and a hospital, the gifts respectively of C. W. Seamans and H. H. Benedict, the founders of the Remington typewriter business.

A well equipped club house and recreation park, honor badges for long and efficient service, a works band, a base-ball league and a field day are some of the other social institutions.

The policy of the corporation has been merely to provide such facilities as are not available from public enterprise in a small community and not within the means of the employees, all the projects mentioned being otherwise wholly managed and financed by the workers themselves.

Plan of Organization Saves Room

As a result of the organization and the system followed a very compact industrial unit is obtained occupying less than 300,000 square feet of floor area with its manufacturing operations and covering with its buildings and yards a rectangular plot of land only 1000 feet long by 250 feet wide. There is no waste or unused space anywhere within the various buildings or yards and the time occupied in mere handling or transport of work in process is cut down to a minimum owing to the ordered sequence of the operations, their close proximity and the rapid flow of the stock.

The buildings contain 1600 machine tools operated by mechanical power and 60 operated by hand labor, besides a large quantity of finely made and costly jigs, tools and fixtures and other labor-saving equipment. Many of the machines have been specially designed and constructed at the works. The greater portion, however, are standard machine tools with slight adaptations for repetition operation by straight piece work under studied conditions which enable them to be used on an intensive scale not attempted in ordinary engineering. The automatic screw machines, for instance, 160 in number, are all run on a piece-work system under close inspection and the ordinary, somewhat indifferent, day operator of a group of machines has been transformed into a busy and vigilant opponent of idle spindles.

Core Binders

The number of cores per man per day is influenced by the character of the binder, since if the material tends to stick to the core box, the workman cannot produce as many cores as in a free working material. In many binders the trouble with the sticking is found to be due to too strong a mixture and as soon as the proportion of binder is reduced, the trouble disappears. In the cost of drying, the length of time it takes to dry each different class of cores when using different binders, determines the capacity of the core ovens, their fuel consumption and the floor space which must be devoted to equipment of this kind. Quick-drying core mixtures increase the capacity of the core ovens and so decrease the plant expense.

An Efficient Drawing Room System

By George W. Meyncke

A group system of filing drawings devoid of card indexes and other commonly used methods.

Its chief advantage lies in the fact that all similar drawings are filed together, thus effecting an accumulative reference value.

A number of drawing-room systems have been described in the AMERICAN MACHINIST, but the group system of filing drawings, used by the Peters Cartridge Company, has some new and original ideas that have been giving good results.

The company manufactures over 100 different calibers of metallic cartridges and five gages of paper-shell cartridges, four of these gages being made in six different styles and one in one style only. The company makes all its own tools and most all of its machinery, so the variety of work handled by the engineering department is necessarily very large and requires a well planned system.

Contrary to most systems no card indexes are required. Drawings are given consecutive numbers, but their use is merely to check and record the number of drawings made. The group system of filing has advantages over all consecutive or symbol filing, the chief being that it is easier to look over a few similarly grouped drawings than to try to tell by a number of cards, no matter how explicit the titles are, which drawing you want. Also when a number of similar drawings are given to the draftsman designing new work, he can use old or standard parts to better advantage, thus saving work for himself and the shop. But unless a group system is so simple that it practically keeps itself uptodate, the work of keeping it up will more than offset its advantages.

The consecutive- and symbol-filing systems both proved inadequate here, but the new system is giving complete satisfaction. The manufacturing is divided into three divisions: Metallic department; paper-shell department, and the primer department. For convenience all drawings were so divided and given the symbols *M*, *S* and *P*, respectively.

Drawing of metallic tools are numbered *M T* 1, *M T* 2, etc.; of machinery, *M* 1, *M* 2, etc.; tables of metallic data, *M D* 1, *M D* 2, etc.; of paper-shell tools, *S T* 1, *M D* 2, etc.; of paper shell machinery, *S* 1, *S* 2, etc.; tables of paper-shell data, *S D* 1, *S D* 2, etc.; primer tools, *P T* 1, *P T* 2, etc.; primer machinery, *P* 1, *P* 2, etc.; and tables of primer data are numbered, *P D* 1, *P D* 2, etc.

MAX. REDUCING GAGE			25–35	
DR 6-30-11 B.D.	SUPERSEDES *M T* 103	SUPERSEDED BY	*MT* 103-1	5
CH				
AP	CHANGES /			

AM. MACH.

FIG. 1. STYLE OF DRAWING TITLE

METALLIC-TOOL DRAWINGS

All tool drawings and as many machinery drawings as possible are put on 9x12-inch tracings and filed in envelops which are kept in 12x15x4-inch heavy board boxes, which open at the end and are filed in racks along the wall. There are 165 boxes in the drawing room and an equal number in the fireproof vault, where the records are kept. It was originally intended to have only one set of boxes, those in the fireproof vault. But the vault being some distance from the drawing room, the extra cost and risk of fire is more than offset by having the drawings handy, all drawings being insured by a record print, as soon as made. Drawings too large for the envelops are filed in tin tubes in the fireproof vault. These tubes are numbered the same as the envelops.

The tools used for the manufacture of the metallic cartridges (*M T* drawings) are divided into three divisions, the shell tools, bullet tools and loading tools. They are marked with letters *S*, *B* or *L* in the lower right-hand corner. See Fig. 1. Tools for each caliber are filed in one of the boxes, marked with the caliber, which contains four envelops, a bullet, shell, loading and data envelop, in which *M D* drawings relative to that caliber are filed.

When the same tools are used on more than one caliber, blank sheets are numbered and filed in the other calibers. Later, should the tools be changed so as to differ, they are drawn on this sheet.

		30 Gov 06	30-40 Krag	30 Gov 03			303 Sav		30-30	30 Rem.	30 Luger		30 Short	30 Long		32 Colt Short	32 Colt Long		32 CNP	32 ACP	32 LCF	32 CLMR							32 Rem.
Reducing	1-Die-Punch	703	927						706	877																		873
	2-Die-Punch	704	928						707	875																		870
	3-Die-Punch	98	705																									
	Press Jaws-Under Cut	1313					1278			1396																		1397
	" " Flanged	61	1088						917																			
	Gage	96							1183	38	1107																	44
Verifying																												
Ironing	Arbor	62	63						41																			
	Dial and Jaws									1449																		1450

AM. MACH.

FIG. 2. FORM OF TOOL-RECORD SHEET

To prevent a tool from being redrawn when the drawing may be out or mislaid, they are listed by their number on tool sheets, as shown in Fig. 2. The symbol *M T* is omitted, as all have the same symbol. As new tools are drawn they are entered on this sheet. No changes other than entering new numbers are ever made on the sheets, as the tool always has the same number. When drawings are changed old figures are crossed off on the back and new figures written above or by the side of the old ones. The history of every drawing can thus be told by inspection. As a check, however, a record print is filed away at every change and the change notice from the foreman or superintendent is filed in the *M D* envelop of the caliber it affects.

Primer-tool Drawings

The primer tools are handled similarly to the metallic except only two envelops, one for *P T* (primer tool) drawings and one for *P D* (primer data) drawings are needed. There are at present nine sizes of primers.

In the paper-shell department conditions are somewhat different, and at first glance seem complicated. There are five gages, 10,12, 16, 20 and 28; the first four are made in six different styles, league, referee, target, high gun, ideal and premier, the last in one style only. There are in some cases several different styles of machines doing the same operation using totally different tools.

The drawings are, therefore, grouped according to operation. As the shop is divided into numbered departments, these numbers were used as operation numbers also; that is, department 80 is the tube-rolling department, department 103 is the assembling department. A set of envelops marked with the operation number is assigned to each of the six styles of the four gages (10, 12, 16, 20) and one for the other (28) gage. All tools used on all styles of all gages are filed in standard tool envelops, which are kept in separate files. All tools used on all styles of any one gage are kept in the league envelops under their operation number, and blank sheets referring to league filed in the other styles. To illustrate, the wad-winder plunger for 12-gage league and referee shells is filed in 12-gage 87 L envelop (87 being the department number, also operation number).

	Dept. No.	Envelope Symbol	Symbol of Machine	Pattern No.	Name	Machine No.
Misc.		18			Data of Metallic Dept.	
		18-1			Machinery- " "	
		19			Finished Shell Data	
Annealing	20	20			Standard Tools and Data	
		20-1	M A	1 To 199	Details-Etc.	
Drawing	21	21			Standard Tools and Data	
		21-1	M D	1000 To 1199	Details-Etc.	
		21-2	M D	1 To 199	No. 1 Aut. Feed	
		21-2	"	200 " 399	" 2 " "	
		21-2	"	400 " 599	" 3 " "	
		21-3	"	600 " 799	22 Drawing Press	
		21-4	"	800 " 999	Large Aut Drawing Press	150-151-152
Inserting	22	22			Standard Tools and Data	
		22-1			Details-Etc.	
Heading	23	23			Standard Tools and Data	
		23-1	M H	800 To 799	Details-Etc.	
		23-2	M H	1 To 199	No.1 Vertical Header-22 Cal.	
		23-2	M H	200 " 399	" 2 " "	
		23-3	M H	400 " 599	Horiz. "	
		23-4				
Length Trimming	24	24			Standard Tools and Data	
		24-1	M T	600 To 799	Details-Etc.	
		24-2	"	200 " 399	Length Trimmer	185 To 229
		24-3			Aut " "	
Head Trimming	25	25			Standard Tools and Data	
		25-1	M T	800 To 999	Details-Etc.	
		25-2	M T	1 To 199	No. 1 Head Trimmer	
		25-3	"	800 " 999	Aut " "	276-277-278
		25-4	"	" " "	Head Trimmer	279 To 282
		25-5	"	" " "	30-Gov-06 Head Trimmer	283

Data Tool and Machine Drawing Record — Met. Shell — Sheet N 49

AM. MACH.

Fig. 3. Specimen Record of Machine Drawing

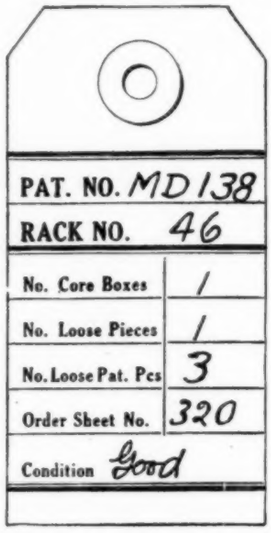


Fig. 4. Specimen Pattern

Machinery Drawings

Machinery drawings are handled similarly to paper-shell tools. The drawings are marked with the operation number and filed in envelops or tubes stamped with these numbers. As a further subdivision and to avoid having too many drawings in one envelop, the numbers are subdivided, as shown by the data sheet in Fig. 3; that is, drawing operation 21 in envelop 21. Standard tools and data are

kept in envelop 21. Details of regular drawing press are kept in envelop 21-1. drawings of No. 1 automatic drawing-press feed are kept in 21-2, etc. Subdivisions are added as required. The paper-shell department has similar data sheets. These sheets also show how the pattern numbers are handled.

All metallic drawing patterns are symboled *M D*, and the range of numbers indicated in the sheet. Patterns are stored in a concrete building in racks. Tags, as shown in Fig. 4, are wired to the patterns while stored away. When wanted for castings the tag is removed and checked for the number of pieces and core boxes, the order-sheet number is written on the tag and the tag kept by the shipping clerk until its return from the foundry, when it is again checked as to number of pieces and condition, the order number erased and the pattern filed in the rack, the number of which is on the tag.

The filing away of the drawings is very easy, as the drawing number plays no part. With the *M T* drawings the caliber tells the box and the *B, S* or *L* the envelop. With paper-shell, or *S T* drawings, the gage, the figure and letter in the lower right-hand corner tell their proper place. The filing of the machinery and data drawings is easy, as the figure in the lower right-hand corner tells all that is necessary. There are at present 3300 drawings and never any time lost looking up lost drawings or writing index cards. The system is very flexible, as any number of calibers and gages can be added without affecting the system. The draftsman that makes the drawing knows where it belongs, puts the number on it and that is all the indexing required.

Core Oven Construction and Use

By H. M. Lane

The underlying principles of core-oven design. "A firm installing a core-oven will frequently order from the lowest bidder. From the day such an oven comes into commission it is a constant expense in the way of spoiled cores and time spent in unnecessary manipulation."

The fuels used; the operation of continuous core ovens and chamber ovens; and core-oven cars.

*Extracts from a paper presented before the American Society of Mechanical Engineers.

Core-oven Design

It is not intended in this paper to go into an exhaustive discussion of core-oven construction, but the underlying principles of core-oven design will be stated. If it is to be efficient it must be so constructed as to maintain a practically uniform temperature throughout the entire drying chamber. For the best results the extreme variations between different parts of this chamber should not exceed 60 degrees Fahrenheit. There also should be a proper circulation through the oven to insure the carrying off of any steam generated during the first period of drying of cores and to afford an ample amount of oxygen for oxidizing and drying oil binders. Where no oil binders are used and the cores are dried in batches, it is advisable to vary the amount of circulation through the oven at different periods of the drying process, so as to avoid undue oxidation of certain classes of binders toward the end of the drying period.

The most modern mistake made in core-oven design is that of locating the firebox too close to the oven, and of discharging the products of combustion into the core-drying chamber at too high a temperature. This practice renders certain portions of the oven inoperative for efficient baking on account of the fact that if any cores were located in these hot parts they would be burned. In the oven there should be ample space between the combustion chamber, or firebox, and the oven, or drying chamber, for the mixing of the products of combustion so that they will have a uniform temperature when entering the oven, and this should be the maximum baking temperature of the oven. The most efficient ovens that have come under my attention have all had their firebox located at some distance from the oven proper, or else have had a large mixing chamber introduced in the flue between the oven and the firebox. In one case there is a battery of ovens constructed with fireboxes in the basement and the ovens are located two stories above. The flues are so arranged and provided with dampers as to make it possible to control the temperature and volume of the incoming gases entering each oven or oven compartment. A provision of this kind insures rapid drying without any danger of burning the cores.

Steam-heated Core Ovens

For some classes of binders steam-heated ovens are excellent, since they insure control of the temperature and preclude any possibility of its rising above the desired maximum. The fuel economy of the steam-heated oven, however, is very low, and hence some form of direct firing by carbonaceous fuel is generally depended upon.

Core-oven Fuels

The fuel used must be one that does not give a smoky flame which would cover the cores with soot. In consequence, anthracite coal, coke, fuel oil and gas are the fuels commonly employed. The products of combustion from anthracite coal and coke are carbon dioxide, with possibly a little carbon monoxide, if there is imperfect combustion. With these are mingled a large amount of nitrogen, which is passed through the oven with the air supply to provide oxygen for the combustion of the solid carbon. All of these gaseous products are efficient drying agents and have the power of absorbing moisture and carrying it from the core oven with them.

Turning to fuel oil or gas as a means of heating the oven, an entirely different set of fuels is encountered. Both of these fuels contain larger percentages of hydrocarbons, all of which burns to water, which passes off as steam and as its temperature falls in the core oven it tends to saturate the air with steam and hence is not efficient as a means of carrying moisture from the oven. In other words, while all of the combustible material in oil or gas produces heat when it is first burned, the products of combustion are of such a nature that much of the heat is carried through the oven locked up in the steam resulting from the burning of the hydrocarbon compounds, and so is not available for the drying of cores. The exceedingly high thermal efficiency of gas and oil, however, and the fact that the use of fuels of this kind does away with the handling of coal or ash, may make it advisable to use such material, though it is not the most efficient fuel.

Continuous Core Ovens

In the case of continuous ovens where the cores are carried by mechanical means, care should be taken to see that there is no hot spot in the ovens where the temperature exceeds the safe drying limit for the binder in use. Cores may be made to resist high temperatures by spraying the surface of the cores to increase the percentage of binder in the surface, but this is expensive since in spraying cores much of the material is

wasted, and the operation itself takes time. It is far more economical to design the oven so that it will bake the cores with the maximum degree of rapidity and at the proper temperature, than to try to utilize improperly designed ovens by doctoring the core-room practice. One advantage of continuous ovens over many of the other types is that the temperatures of the different parts may be controlled so as to give the most rapid and efficient drying possible, but this is true only where the cores are approximately uniform.

Chamber Ovens with Shelves

For chamber ovens in continuous use, the cores being dried on individual shelves, it is necessary to determine the condition of the drying by inspecting the cores. In such ovens the products of combustion usually rise and pass out of the top and if there are partially baked cores on the upper shelves and subsequently green cores beneath them, the steam driven out of the green cores passes over the dry cores and the moisture may, to some extent, be absorbed by the dry cores, thus retarding their baking. In any case the presence of steam in the ascending current of air will retard the baking on the upper shelf. This is one reason why the lower shelves of a drying oven frequently bake faster than the upper shelves, even when the temperature of the incoming gases is kept well below the maximum allowable for the oven.

Distortion of Metal Parts of Core Ovens

Core ovens have been arranged in many cases so that the fire was 1 to 3 ft. from the cores being dried. The core cars have often been warped and bent out of shape by the fact that the flame from the fireboxes played against them. Iron will not be distorted at any temperature that is safe for the baking of cores, hence any warping of any metal work in the oven is evidence of too high temperature. For the proper regulation of the temperatures in core ovens, recording thermometers should be applied not only to the ovens themselves but to the main heat flues.

Core-oven Cars

For efficient core-oven work the car must be designed so that it will support the cores without any danger of being distorted. The tracks for supporting the car must also be rigidly supported and kept in perfect condition. Too little attention is given to the design of this part of the core-room rigging. A firm installing a core oven will frequently order from the lowest bidder. From the day such an oven comes into commission it is a constant expense in the way of spoiled cores and time expended in unnecessary manipulation in getting the work to and from the oven. The core trucks or cars should run into the oven as easily as any other part of the industrial transportation system, and there is no need of having to bring a 25-ton traveling crane to the front of the core oven and couple it to the truck by an intricate system of chains and blocks in order to shove five tons of cores into the oven.

The Cost of the Special Order

By C. J. Morrison*

Those who, at one time or another, have built special articles of unique design, must have been impressed by the high cost of such articles. The first one of a design frequently costs many times the figure ultimately attained when the article has been manufactured regularly. Yet, regardless of this experience, articles of special design are continually ordered. In fact, the special order is today the bane and terror of many concerns. The cry of how profits could be made if the special order were eliminated is heard on all sides.

The manufacturers are themselves largely to blame for the prevalence of the special order. Had they taken a firm stand and insisted on making only the standard product, the special order would never have become such a menace to business. However, the fear of an order going to a competitor usually made a concern accept a special order, even though a loss was foretold.

When It Pays to Lose an Order

In many cases a concern has not only lost money on a special order, but in the end has lost a customer on account of the special not being satisfactory. Perhaps the fault was entirely with the customer, but putting the blame on the customer seldom tends to soothe him. In such a case it would certainly have been far better in the first place to have allowed the deadly rival to take the order, for the customer would have returned and been more firmly attached than before to the first concern.

Special orders must of necessity cost more than standard articles, but they cost a concern even more than the figures will ever show. The disruption of the regular routine of the work puts an additional cost on the regular product, and, in addition, always retards the operations and reduces the output. Furthermore, it is frequently necessary to make special tools or fixtures, which add to the general burden.

In many cases the special design is not as good as the standard. As a matter of fact, the chances are against its being as good, for the reason that the standard article is the result of careful design and of the combined experience of many users.

*Manager, engineering department, Suffern & Son, New York.

Special Orders Unsatisfactory All Around

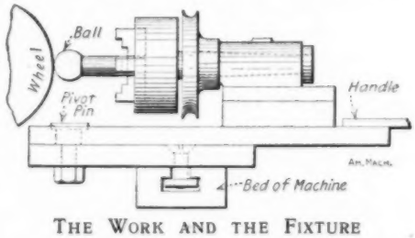
From the standpoint of the customer the special is usually unsatisfactory. As a rule it costs him more, he has perhaps secured it only after exasperating delays, in case of failure he has no redress, and repair parts will have to be made special. The question of repairs may be very serious in a case where a number of workmen or the output of a plant is dependent upon the machine.

The special order, being undesirable from every standpoint, should be eliminated. It is up to the manufacturer to take a firm stand and drive the undesirable to the wall. The constant fear that a customer will go to a competitor should be dismissed, for the surest way to put the rival out of business is to let him have the special orders. He will not be able to hold the regular orders, because the firm free from specials can underbid him and still make a profit.

Grinding a Ball on the End of a Shaft

By W. Andrews

In repairing a machine it was found necessary to make a hard-steel ball 1 inch diameter at the end of a 5/8-inch threaded shank. The line cut shows how we rigged the small Cincinnati tool and cutter grinder to finish the ball. The attachment is cheap to make, and we were



The Work and the Fixture

able to grind the ball to within 0.001 inch of spherical; this was as good as the job required. The ball was rotated and the fixture was swung around the pivot pin. The center of the pivot pin was exactly perpendicular with the center of the ball.

In the earliest foundry practice cores were made from mixtures containing no artificial bonds. A sand was chosen containing enough clay to hold the grains together when dry, and if this showed a tendency to stick to the casting some sawdust or other carbonaceous material was added to the mixture, causing it to fall to pieces next to the casting more easily and clean out better. It is probable that the first artificial core binders used were rye and white flour and pea meal, and there are also records of the use of sour beer.

How Machines Are Designed

By Frederick P. Glosh

The starting point, steps of development, preparation of drawings and making of details in the design of a special machine. The method outlined is the result of an extended experience in such designing.

The very interesting and instructive article under the above title on page 494, written by Entropy, and that gentleman's request for a further discussion of this matter in these columns, have led me to attempt to dissect my own experience. In thus telling what I have found to be a good way to start and finish the design of a machine, I hope my example may be followed for the benefit of others as well as myself.

Specialization of Designers

It is right to assume that there is a class of machines which might be termed "standard," such as drillers, lathes, planers, shapers and others. Thus it will be understood by the reader what is meant by "standard" in the following. Designers connected with firms building any of the above machines (it matters little what type) are, generally speaking, experts in their various lines. In other words they have specialized to a point of proficiency which would be hard for an outsider to equal. It is only fair to assume that a man who has spent all of his time in the designing of radial drillers is a better man to place on a new design for a machine of the same character than a man who has had his experience in the designing of grinders. Following this trend men become specialists in their various classes, and no doubt the best of results are obtained as the excellent line of machine tools on the market today will testify.

There is another class of designers, however, and it is in this class that I have had the most of my experience, hence it is the latter class which will be discussed.

Special Machines

It seems unnecessary to go into detail in order to define the meaning of the expression "special machine" further than to say a special machine is a machine designed to produce some particular article for which there happens to be a market of sufficient proportion to demand a design of a machine that will produce this article in better, larger and more economical quantities than machines which can be bought on the market. Such machines have been developed before and, as the reader knows, some of them are today of the "standard type" mentioned above.

The Start of a Design

A thorough knowledge of the article which the machine is to produce is necessary on the part of the designer, or at least by those in authority willing to pay out good money. It is up to the latter to give the designer all possible information and leads which, in the long run, will save time and money. It is here assumed that the designer is thoroughly familiar with the subject, and so makes a start on the tools which are to be given the first consideration. Now, tools may be tools, but some tools are no tools at all, at least they are not suited for the work simply because a designer has neglected to give this important matter proper consideration; thus finding in the end that, while the general design of the machine is good, it has proved a failure on account of the inattention or I-don't-care method of making provisions for tools.

Having decided as to the kind of tools that will be used, provisions must be made for holding and carrying them. At this stage it behooves the designer to be careful, as this is also a danger point to be passed over very slowly, using extra precaution so that holders and carriers have sufficient metal and surface to take care of vibrations and any spring which may occur. If this is not done it matters little how well the tools may be adapted for the work in hand, for the result will be very unsatisfactory. Care must be taken so that the overhang is reduced to a minimum, at the same time bearing in mind that the access to these tools must be easily had, so that the operator can change or adjust them without unnecessary delays.

Before a definite decision has been made as to the style of tool carrier, it might be well to stop and consider the question as to whether a single- or multiple-spindle machine will work out to the best advantage. This decision, in a measure, will govern the kind of tool carriers necessary, as well as give the designer a general idea of center distances for the spindles.

Speeds and Feeds

Having decided the last questions, which also embody the capacity of the chucks and spindles, the designer may stop the actual design at this point in order to take up the question of speeds and feeds. A careful and complete record of all calculations must be kept within easy reach for reference at any time. Having determined the drive, the designer will then have a better foundation to start on the actual design of the machine as a whole, because the source of power or drive in most cases will govern the type of frame or main housing and also the center distances of the various points of connections.

Starting the Actual Design

I have found it profitable to make a number of free-hand sketches, embracing the various sections of the main housing, bearings, brackets, levers, etc.; in fact try to memorize and produce to the mind an actual picture of the machine as it will appear when built, filing these sketches with the calculations in connection with them for future reference. Since satisfactory results cannot be accomplished by a single bound, it is necessary to be patient and advance step by step, taking advantage of well established principles and not forgetting what the other fellow has done.

Laying out the various movements singly, full size if possible, and afterward placing them where they are to fit in, I have found to be a good "stunt," because of the fact that the designer has, for the time being, concentrated his thoughts on one particular movement. The development of this one is generally more satisfactory than if a number are considered simultaneously. In the former way every part may be sized up from a theoretical, practical and commercial standpoint. Connections for these various movements might be considered; it may be found that at this point an advantageous change here and there will not materially alter the design as a whole.

Designing the Control

Control, no matter how simple or intricate the machine, must be within easy reach of the operator. All controlling levers and devices should be so placed that the operator may always be in a position to keep one eye on the work when reaching for stop or starting levers, speed and feed levers, etc. Furthermore, these devices must be so placed that all chances of the operator being injured in reaching for them are eliminated. The above, of course, will, in a measure, govern the connections of the various movements. Only by a careful analysis of the positions the controlling members are to occupy can possible errors be overcome.

We have now reached a point where we can size up the machine as to its length over all, its width, and approximate overhang of all projecting parts. These being satisfactory, the designer is now ready to start work on the details.

Detailing

It is not my wish to have the reader feel that the method herewith described is the best, but rather that it is a method which is the best that I have so far come in contact with. Cross-section drawing paper is used, as this eliminates the use of a scale almost entirely, the paper is graduated in eighths, and a division of 1/64 inch is easily marked by the eye. Fillets of one-quarter inch radius and smaller may be drawn free hand, penciled dimension lines are unnecessary, all that is required is to mark the arrow heads, using the graduated lines in most cases for dimension lines. The graduations answer as an excellent check for overall dimensions. Only the squares need be counted.

This kind of paper will make an excellent blueprint when inked in, and in a pinch or on a hurry-up job a fairly black pencil drawing will make a print as good as a lot of those which have come to my notice.

The design of every detail is carried out with the thought in mind as to its lines, corners and surface. However small the piece may be it has to go through a theoretical, practical and commercial refining process. A designer who has charge of a drafting room will know exactly as to what men are best on the various parts of the machine, and so hand out the work for detailing accordingly. Of course, it is understood that "team work" is a necessary adjunct in doing work in this way to avoid a mix-up in the end.

Parts that require patterns are detailed first to hustle them to the patternmaker; these are also kept on separate sheets from the forgings and machine-steel parts. Where the designer does not make the working drawings himself, it is necessary to give the men working on the detail an idea as to how certain parts ought to look (this will save the eraser and incidentally some time). The man making the details must keep in his mind's eye at all times the workmen and the equipment available to create the designer's intention in metal in the shop; for that reason he should ask himself the following questions:

How can this be made?
Can it be made cheaply?
How about lubrication?
What is the best material?
Can it be readily taken out for repair?

The proper consideration of the above questions is only a matter of business, for designs that cannot be built as a business proposition are no designs at all whether the machine is special or otherwise. It is safe to say that there is no one thing productive of more trouble and embarrassment and waste of time and money in the works than a poor detail drawing, in fact the efficiency of the entire machine may be at stake. A failure may be recorded against the designer unless he keeps his weather eye on the details.

Checking Details

I agree with former contributors to these columns that the best results are had by having some other man do the checking, rather than the man who made the drawing. The checking is carried out thoroughly as to general appearance of the parts, which includes its cross-sections, surfaces, dimensions, foot notes and printed instructions.

A general construction drawing is now made from the details to some convenient scale that will embody as much of the whole machine as possible. This method has been found to serve a valuable purpose in giving the parts a double check, as strict attention is paid to all dimensions and notes in assembling the various parts.

Errors which have escaped previous notice are often discovered in this way.

Numbering of Parts

The numbering of patterns and parts for a machine, and the keeping of a complete record for ready reference and systems for handling have been discussed many times in these columns.

It may be said, however, that in order to handle a new design for a machine from start to finish in the drafting room, foundry and machine shop, some system of numbering the various parts is very essential; especially is a system of some kind a valuable help to the cost department. It follows, therefore, that a designer who has charge of a drafting room must possess essentials other than being a mere scientist, practitioner and artist. To some degree he must be a systematizer.

In summing up it remains to be said that machine design is the art of mechanical thought. An art because its routine process may be analyzed and applied.

Mechanical thought is the thinking of things from a mechanical standpoint, a study in theory, practice, structure, production and specification. Specifications imply the detailed description of the design to such an extent that the shop man is enabled to construct completely and place in operation the machine represented in the design.

The time-worn expression, "The drafting room is a necessary evil," has played its part and has no supporters in the uptodate shop.

In the demolition of an old gasometer in Hamburg, Germany, built about 1852, the iron anchor bolts incased in cement concrete were found to be as fresh and bright as new iron, and having no traces of rust. This is an attestation of the preservative qualities of concrete and is a remarkable record.

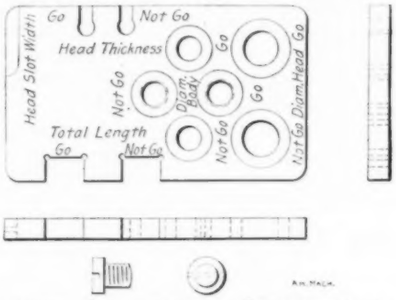
Limit Gage for the Inspection of Screws

By F. Charles Scribner

The accompanying sketch shows a limit gage for the inspection of screws, which should recommend itself to the attention of draftsmen who have to design gages for such work.

The plate, made of ¼-inch smooth-drawn, low-carbon steel, is ground down to a thickness of $\frac{7}{32}$ inch for which purpose the material is cut to a length of two feet and ground on the Pratt & Whitney vertical surface grinder.

The gaging sizes for diameters are provided for by means of hardened tool-steel bushings having lapped holes and



A Limit Gage for the Inspection of Screws

being ground on the outside diameter to press into the holes in the plate. The plate being previously machined with allowance for grinding the slots for "head thickness" and for "total length," is then pack-hardened and the slots ground and lapped out to the proper dimensions, after which the bushings are pressed in.

This construction makes all gages for the testing of the screw compact and self-contained and also makes it an easy matter to renew any bushing when worn or when, as it occasionally happens, a size is changed.

In this work it is found that the bushings are subject to more wear than the slots; hence the necessity for provision for their renewal.

To fix pencil lines on drawings, rub the drawing with a piece of wax like that used in the manufacture of phonographic rolls. This produces a kind of varnish which protects the lines against rubbing and insures their preservation. Paper as well as tracing cloth can be protected in this manner. Another method is to heat the paper slightly before using it, then spread a solution of warm alcohol and bleached colophone rapidly over the surface so as to thoroughly wet it, after which it is to be dried in warm air. The pencil works easily on the surface of paper so prepared. In order to fix the lines, it is merely necessary to reheat the paper slightly for a few moments. The lines are then covered with a thin coating of transparent varnish, which preserves them in perfect clearness.

Letters from Practical Men

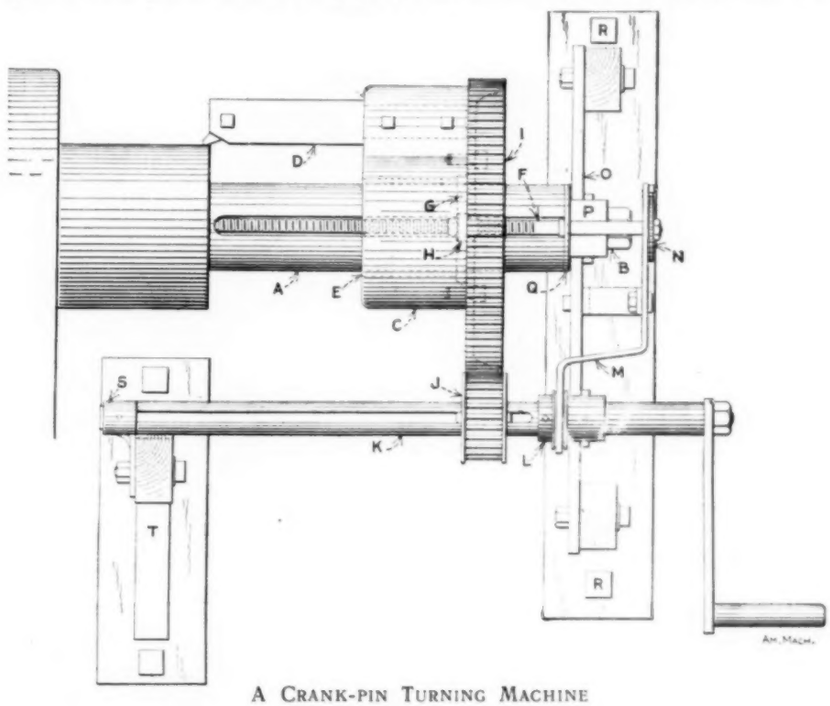
Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

A Crank Pin Turning Rig

I am master mechanic in a large cotton mill. We have four pairs of cross-compound Corliss engines averaging about a thousand horsepower to the pair. The engines have been in use for some time and the crank pins were badly worn. After unsuccessful attempts to true (?) these pins up by filing, I had made in our shop a machine which I will describe as follows.

The mandrel *A* of the machine is bolted to the crank pin by a long stud, passing through the center of the mandrel, one end of which screws into the tapped hole in the center of the pin. The other end is shown with a nut on it at *B*. On the mandrel *A* is mounted the hub *C* with a lug which carries the turning bar *D*. The hub is provided with a split bushing *E* split on an angle to eliminate any jump when passing over the slot for feed screw *f* in the mandrel. In the hub *C* a recess *G* is cut to take the tail of the feed nut *H*, the back of the recess being closed by the gear *I*, which is bolted to *C* and driven by pinion *J*. This pinion has a key gibbed at both ends and sliding in the spline of the driving shaft *K*. The collar *L* on *K* acts also as a cam to actuate the feed arm *M*, which has a fork end fitting over the cam and is supported in the center by a bracket as shown. The other end has a pawl engaging with the 40-tooth ratchet gear *N*. A flat bar of iron ½x2 inches marked *O* carries the bearing for the driving shaft *K*, the bracket for the feed arm and a support *P* for the end of the mandrel *A*, which is turned smaller at the end and has a plate *Q*, which acts as a bearing and thrust for the feed screw. The other end of feed screw runs in a hole bored at the end of the slot in mandrel *A*.



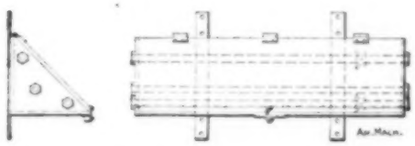
A Crank-pin Turning Machine

The bar *O* is supported by wooden uprights in a wooden base resting on the engine room floor and held there by lag screws *R*. This construction is also applied to the bearing *S* at the inside end of the driving shaft *K*. This post has a brace *T*. All three posts are slotted so that their fittings can be adjusted to hight. The driving gear has 110 teeth and the pinion 28. This keeps the feed from coming at the same place in each revolution and also brings the crank and the tool to different positions. We have turned five pins with the machine so far and have had excellent results. As the mandrel is a little loose on the stud it can be moved to bring it to the center of the pin; also a thin shim can be placed between the end of the mandrel and the face of the pin, but so far we have not needed this and have finished the pins with the tool only, finishing with a "water" cut. Since the drawing was made from which the inclosed print was taken, I have added a weight on the large gear to counterbalance the turning bar.

Quebec, Canada. Albert E. Fry.

Tracing Cloth and Detail Paper Cabinet

In the accompanying sketch is shown a cabinet for tracing cloth and detail paper. It is made of pine lumber, one 1-inch cold-rolled steel shaft to carry the paper and two ¾-inch cold-rolled steel shafts to carry the tracing cloth. This cabinet was made for 60-inch paper and 36- and 42-inch cloth, collars being used to hold both rolls of cloth in position.



Tracing Cloth and Detail Paper Cabinet

The door hinges at the bottom and has a small door catch at the top. Two pieces of ¼x2-inch flat cold-rolled steel are fastened to the back of the cabinet and form hangers for holding it in position on the wall. The top of the cabinet can be used for storing magazines and other articles before they are ready for filing in their proper cabinets.

This cabinet gives the drawing room a tidier appearance, as the paper and cloth must always be kept in position and it also saves considerable time as one always knows where to find it. Its cost is an economical expenditure in any sized drawing room.

St. Louis, Mo. C. T. Schaefer.

Shaping Short Curved T-Slots

We have a great many irregular-shaped pieces which have a short, curved T-slot, as shown in Fig. 1.

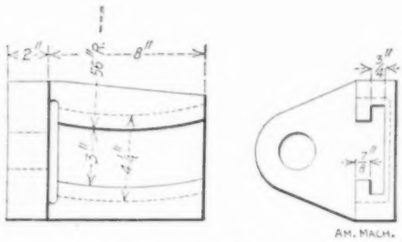


FIG. 1. THE WORK

These T-slots or dovetails frequently run up close to a shoulder, as shown, which precludes the possibility of milling.

After considering various methods it was decided to rig up a traveling head shaper in the manner shown. Two cast-iron platens *A* and *B* were made of sufficient length to take the longest radius required. The swinging platen *B* is pivoted at *P* to the platen *A*, which is bolted to the shaper knees. The platen *B* is prevented from lifting the strip *S* which is bolted to the platen *A*. A cast-iron guide bracket *D* is securely bolted to the traveling head, as shown, the special connecting arm *F* driving the rod *E* back and forth, through the bracket *D*, thus giving the platen *B* a swinging or oscillating movement. The casting *C* is made just high enough to admit the work under the tool box of the shaper head plus a little clearance, and connects with the rod *E* through the link *H*.

The shaper ram is clamped tight in the slides and the driving belt crossed to give the quick return in the proper direction.

The work is clamped to the platen *B*, and located in correct position by trams from the pivot *P*.

This device has proved highly satisfactory in every way and is adapted to a wide range of work.

J. C. VERITY.

Washington, D. C.

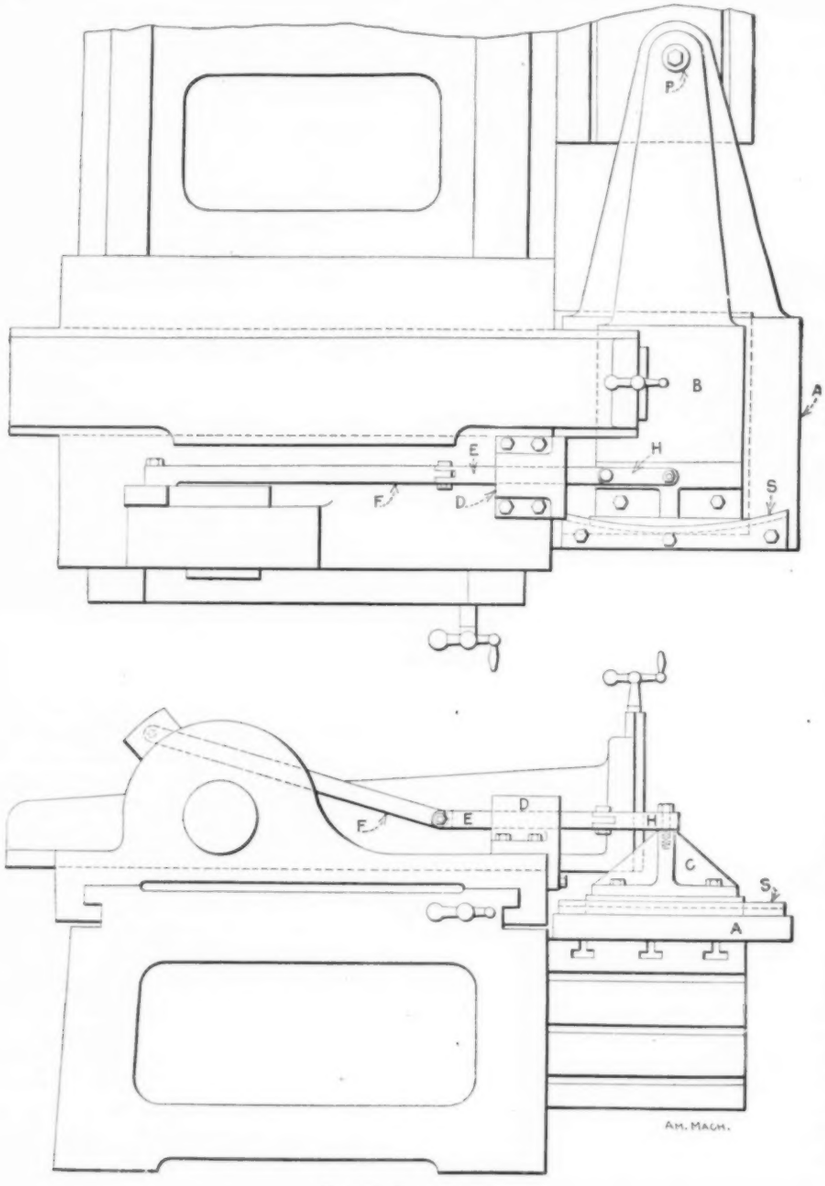
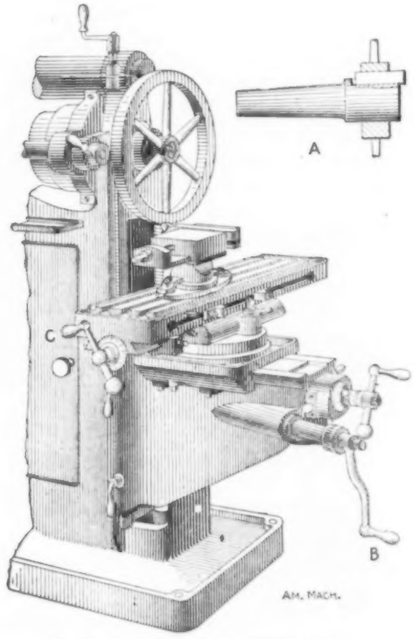


FIG. 2. THE RIG

Turning Spur and Bevel Gears on the Miller

Some time ago, when employed in a factory where the machine-tool equipment was an ancient driller, a 10-inch lathe, a No. 2½ Cincinnati universal miller and a shaper, I was called upon to machine several 14-inch gears, and as they would not swing in our lathe, I conceived the idea of turning and boring the blanks in the miller, using the vise to hold the tools.

After being bored and one end of the hub faced, while held in a universal



TURNING GEARS ON THE MILLER

chuck on the miller spindle, they were keyseated in the shaper, placed on the mandrel as shown in the cut, and the periphery and the other end of the hub faced.

The mandrel used was made from an old end mill and the gears were pressed on and keyed, as shown at *A*. The taper shank of this mandrel fitted both the miller spindle and the dividing head, so the teeth of the gears were easily cut, the dividing-head spindle being set vertical and the gears fed to the cutter on the miller arbor by means of the table elevating screw *B*.

In turning bevel-gear blanks we used a small machine vise for holding the tool,

the vise being secured to an angle plate, which was bolted to the table; the table was then swung around the required number of degrees and the tool fed along by using the table screw *C*.

New York, N. Y. JOHN D. COOLEY.

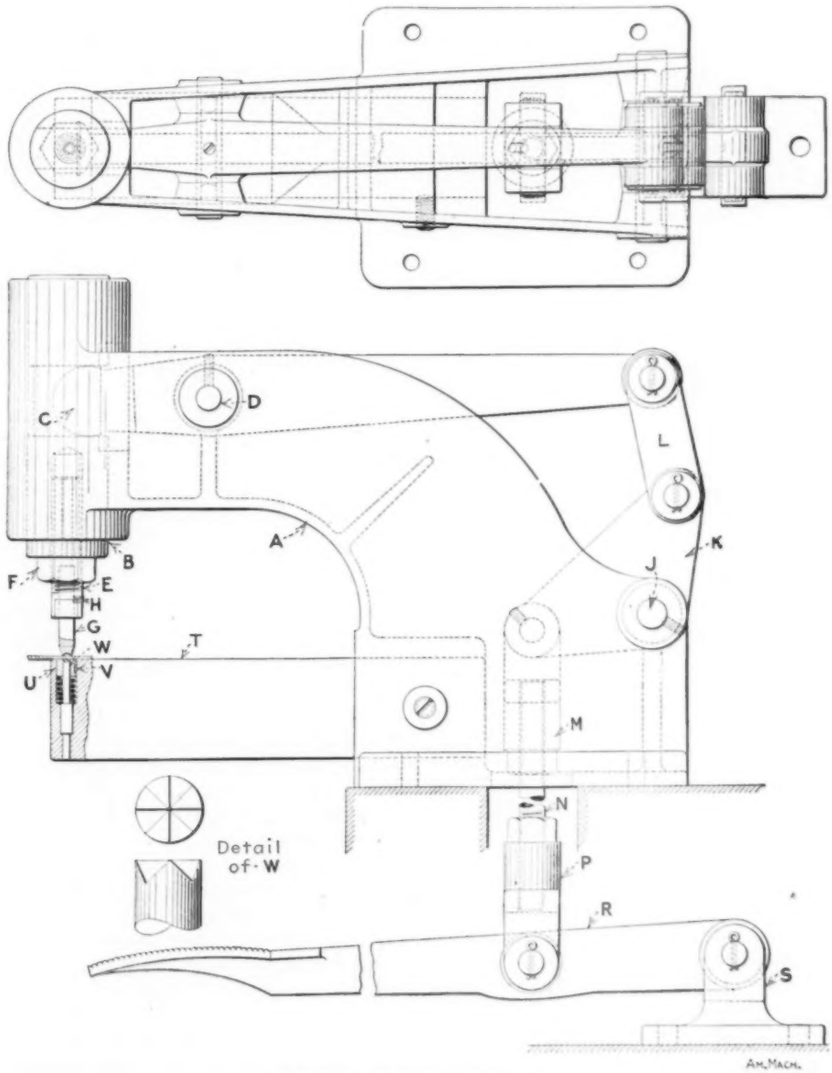
A Small Toggle Riveting Press

While inspecting the manufacturing equipment in one of the automobile-accessory concerns in Detroit, the writer was shown a small foot-power riveting press, which, on account of its simplicity and efficiency, should be a useful device in many small manufacturing plants. The presses are utilized for the riveting together of sheet-metal parts of moderate thickness and have successfully superseded hammer riveting with its attendant disagreeable noise, at the same time producing much more uniform and shapely results.

There are many cases where the rotary rivet-spinning tool is entirely satisfactory, although it is practically impossible to spin a rivet head which comes in close proximity to a projection on the surface of the work, such as near a flange, for instance, owing to the necessary diameter of the rivet-spinning rolls and holder.

With the device illustrated this condition is taken care of and the operation is rapid, silent and efficient. The press frame *A* is an iron casting of such a cross-section as to give the necessary rigidity; it is provided with a flanged base containing bolt holes for its attachment to the bench by means of lag screws.

A vertical sliding ram *B* of machine steel operates in the larger boss at the end of *A*, and is actuated by the rounded end of the cast-iron lever *C*, working in the slot in the ram. The lever *C* is fulcrumed on the steel hinge pin *D*, through bosses on the frame. The lower end of the ram *B* is tapped to receive the rivet punch holder *E*, by means of which vertical adjustment of the rivet punch is obtained and which is locked in a predetermined position by a check nut *F*.



A SMALL RIVETING PRESS

The rivet punch *G* of hardened and tempered tool steel fits into a counterbore in the lower end of *E*, in which position it is retained by the small setscrew *H*. The lower extremity of the rivet punch is tapered and cupped to conform to the shape of the rivet head being used.

Pivoted between the side flanges of the frame casting *A* on a steel pin *J* is the cast-iron bell-crank toggle member *K*. Two steel toggle links *L* connect the upper end of *K* with the end of the operating lever *C*, and constitute a very powerful toggle mechanism. To the lower extremity of *K* is attached a cast-iron clevis *M*, into the shank of which screws the steel tension rod *N*, which connects the bell-crank lever with a cast-iron foot-pedal clevis *P*.

Check nuts, as shown in the illustration, serve to lock the rod *N* in a predetermined position. Small setscrews are used to lock the various hinge pins in position with the exception of the toggle-link pins and the foot-pedal clevis pins, which are retained by cotter pins. The foot pedal *B* is of cast iron and is fulcrumed between the jaws of a cast-iron floor clevis *S*, which in turn is attached to the floor by heavy lag screws. The outer end of the foot pedal is spade-shaped and corrugated to prevent slipping of the operator's foot.

A steel horn *T* projects from the front of the frame and carries at its outer extremity a hardened-steel pressure bushing *U*, sliding within a helical steel spring from below, as shown. The vertical travel of this bushing is limited by a cross pin *U* in the horn *T*. A hardened-steel rivet spreader *W*, whose upper end is beveled to form a cross, as shown in the detail view, serves to compress and spread the shank of the rivet.

THE OPERATION OF THE DEVICE

The operation of this device is as follows:

Assuming the ram *B* is in its extreme up position, the rivet is inserted manually in the hole in the parts to be riveted together, with the head of the rivet on the outside of the work. The work is then inserted in the press and elevated until the rivet head rests within the cupped end of the punch *G*. The foot pedal is then depressed, causing the work and ram to descend together until the pressure bushing *U*, which at this time is in its upward position, is encountered.

The shank of the rivet enters the bushing opening, which, of course, must be materially larger than the rivet shank, and the two pieces of metal are firmly squeezed together by the bushing and its spring. All parts then descend together and the rivet is forced down on the end of the spreading stud *W*, causing both a spreading and compressing of the rivet at the same time.

It is obvious that a suitable stop must be provided to limit the down stroke of

the ram; this can be accomplished by screwing a lag screw into the floor under the foot pedal *R* to the proper depth, so that the pedal will come to rest on the head of this screw.

The press can be designed to conform to any special work of this character, but in this particular instances it has been given the horn construction in order that riveting can be performed upon cylindrical shells, cans and similar articles.

Detroit, Mich. ARON LAWRENCE.

A Job Done by An Old Time Machinist

As reference has been made in former numbers as to the old-time and present workmen, I think some AMERICAN MACHINIST readers will be interested in the following description of a job done by William H. Craig, in 1865 or thereabouts:

It was the main shaft of a machine to do away with movable type, as is done now by the linotype, though in a much less successful way. The machine was exhibited at the Paris Exposition in 1867, and is now in the museum of Sibley College, Cornell University.

The body of the shaft was made from a piece of rifle gun barrel about 10 inches long, ⅞ inch octagon, and practically ½-inch bore, see *A*, Fig. 1. This was plugged at the lower end for a step, and turned at *B* for the upper journal, and otherwise had attachments that have no bearing on the main feature to be explained. At or near the center there is a ⅜-inch mortise 1½ inches long, and a hole in the middle to pass screws through and admit a screwdriver. A closely fitted sliding plunger *C*, Fig. 2, works in the upper end of the shaft, and, to work this plunger, a cross-bar *D* operated by opposite cams serves to raise it while it is returned by a spring. This cross-bar is a perfect *sliding* fit in the mortise in the shaft, and a *driving* fit in the plunger, and secured by two perfectly fitted screws.

These screws are so located that when the cross-bar is in its uppermost position, the lower screw can be passed through the hole in the shaft, through one side of the plunger, through the cross-bar, and screwed in the other side of the plunger.

When the cross-bar is placed in its lower position, the upper screw can be passed through the same hole in the shaft, and finally screwed in place.

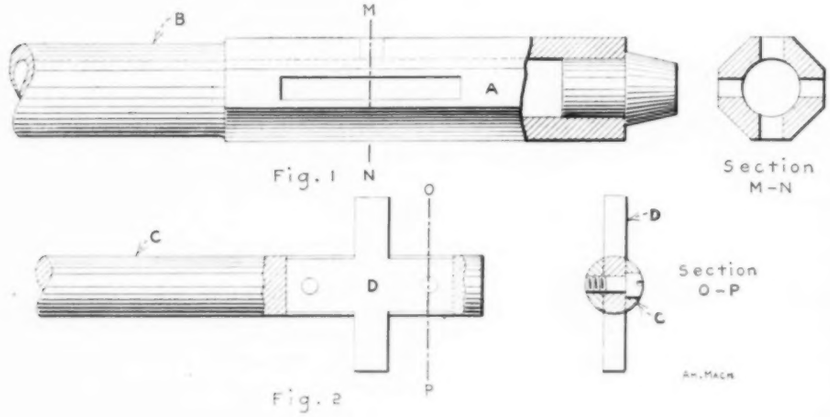
So far, there is nothing so wonderful about this; but, reader, please bear in mind that the cross-bar is a close, sliding fit in the shaft, a driving fit in the plunger, and then that the two screws are a tight fit in the holes, and that the head of the screw is a good fit in the hole in the shaft. And, yet again, so far there is nothing wonderful; but, remove the screws and cross-bar, turn the plunger half around, and the cross-bar and screws will go back in place and work equally well.

Remove them again and turn the cross-bar upside down, and they will all go back equally well and work the same. Or, change sides with the cross-bar, and there is no difference that can be detected.

Furthermore, the lathe work on this, as on the whole machine, was done on a foot lathe; the planer work on all the small pieces on a hand planer that was made to face valve seats: and, to do the small parts described, the drilling was done by the foot lathe, the mortises by chipping and filing, and the only small tools Mr. Craig had to work with were perhaps a surface gage, a Darling & Swarts Bangor scale, try-square, spring calipers and compasses, and homemade taps for tapping for the screws which were lathe cut.

This is what one of the old timers did do.

Syracuse, N. Y. JOHN E. SWEET.

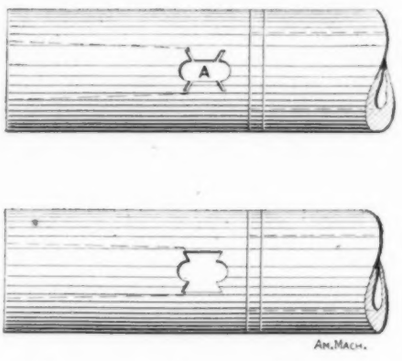


A JOB DONE BY AN OLD-TIME MACHINIST

Repairing the Slot in a Driller Spindle

The slot which holds the drill tang, having worn round in the spindle of one of our drillers, I repaired it as shown in the cuts.

I first sawed four slots, as shown at *A*, with the hack saw, and chipped and filed out the stock, making the dovetail slots slightly taper. I then annealed an old file and, using pieces of it, fitted jaws into the slots, drove them in tight and then dressed the parts smooth with a file.



REPAIRING A DRILLER SPINDLE

This spindle has been in service some time, and, in my opinion, is better than before, as it shows no signs of wear.

New Castle, Penn. L. HULME.

A Patternmaker's Views on Drawing

While many articles have appeared from time to time in the AMERICAN MACHINIST upon drafting, written by the draftsman or the machinist, I do not remember of seeing any written by the patternmaker. Yet, to a great extent, the draftsman should devote his attention to the patternmaker's point of view. The patternmaker starts his work with nothing but his drawing, and a misunderstanding on his part of a single line may cause a serious error, while the machinist has before him not only the drawing, but usually the casting itself, which is represented by the drawing; and in many cases, almost all of the lines upon the drawing may be entirely ignored by the machinist without detriment to the correctness of his work.

It is a noteworthy fact that the patternmaker should make his patterns from the standpoint of convenience to the molder (except in such cases as may not warrant the expense), since it is the molder more than the patternmaker who is to use them; and it would seem as if a parallel condition would apply to the relations between the draftsman and the patternmaker. And as far as the writ-

er's experience goes, this is usually the stand the draftsman takes, much to the convenience and welfare of the patternmaker.

With these considerations in view, a few points will be dwelt upon, which, as seen by a patternmaker, are of the most importance, both as to convenience and prevention of errors.

The importance of the proper placing of views is now nearly universally recognized, and it is very seldom that we find them misplaced, although a few years ago this was a prolific source of argument between the draftsman and the patternmaker.

If the drawing is complicated or of many closely associated lines, the arrowheads at the ends of the dimension lines should be carefully drawn, so that there will be no doubt as to which lines they may refer; likewise, for the same reason *f* marks should be correctly drawn, so that the intersection of the two marks of which the *f* is composed be exactly on the line to which the *f* refers.

Dimension lines should be drawn as lightly and other lines as heavily as consistent. Complicated drawings should not be drawn to too small a scale, for while the drawing may look plain to the draftsman, who knows what the object looks like, and who sees the drawing before the figures and dimension lines are in, after these figures, arrowheads and various necessary data are drawn in, usually in heavy line, the drawing is often so covered and surrounded by them, that it is almost impossible to trace out the drawing itself. The draftsman should remember that while he is making his drawing one-quarter or one-eighth size, his figures and other data will be made full size, and will, therefore assume a disproportionate importance in the eye of the struggling patternmaker, who finds it almost impossible to hold his mental image from one view to another, due to these distractions.

All dimensions which do not scale should be underlined, or otherwise marked, so that the workman will at once recognize the fact that the draftsman knew of the discrepancy.

This is a relief to the patternmaker and saves time as well, for while it is a general rule that a drawing should not be scaled, yet when the workman finds his "layout" or pattern does not agree in appearance with the drawing, he at once wonders if he hasn't made an error in his work. I have known of a man spending an hour or so trying to find the error in his work, and deciding finally that it must be in the drawing. After taking the matter up with the draftsman and suggesting to him that he should have underlined the dimensions which would not scale, and being politely told that they "should not scale a drawing anyway," they have gone away definitely resolved to follow the next mistake they find in a drawing.

When sections are made, especially of which there is already a pattern, reference should be affixed. If the piece being drawn is similar to another, for which there is already a pattern, reference should be made to it, as the patternmaker may utilize the pattern.

If there are lugs or extensions placed on an angle with the main drawing, small side details are a great help in understanding the drawing. Over-all dimensions should be given wherever the lack of such dimensions necessitates any appreciable amount of figuring, both because the patternmaker is more liable to error in this respect than the draftsman, and because he may have to use the dimensions several times, as in making core boxes, checking, etc.

The custom followed by some draftsmen of drawing in dot-and-dash lines, anything which helps to make the drawing clearer, but which, strictly speaking, would not appear where drawn, such as showing a lug on the nearer side of a section, or of representing a corner with a large round or fillet, which would not be properly lined at all, is a very good one, and sometimes saves making another view.

In concluding, the fact should be emphasized that anything which makes for clearness and correctness of understanding should be done, provided the cost does not preclude this, as the correctness of the pattern depends upon the correctness with which the patternmaker reads the drawing.

Battle Creek, Mich. H. N. TUTTLE.

Hints on Safety

In the shops of the H. C. Frick Coke Company, Scottdale, Penn., there have been posted signs that could well be hung anywhere that machinery is used.

This company, in common with other subsidiaries of the Steel Corporation, can be commended for the efforts made to protect its employees from accidents. The notice is printed in large, heavy type, so as to be very conspicuous.

WARNING

EMPLOYEES WORKING AROUND ENGINES, MOVING OR REVOLVING MACHINERY, SHAFTING, ETC., ARE WARNED OF THE

DANGER

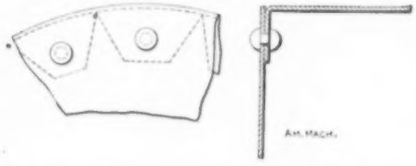
AND ARE PROHIBITED FROM WEARING TORN CLOTHING, LOOSE OR UNBUTTONED JACKETS, BLOUSES, SHIRTS, LONG NECKTIES AND LOOSE SLEEVES. ALWAYS WEAR THE OVERALL JACKETS TUCKED IN THE TROUSERS OR UNDER THE OVERALL BIB. NEVER FORGET TO EXAMINE YOUR CLOTHING BEFORE COMMENCING WORK.

H. C. F. C. Co.

All its employment offices have another notice in several languages and in big print, conspicuously displayed as follows:

"TO MEN SEEKING EMPLOYMENT: UNLESS YOU ARE WILLING TO BE CAREFUL TO AVOID INJURY TO YOURSELF AND FELLOW WORKMEN, DO NOT ASK FOR EMPLOYMENT. WE DO NOT WANT CARELESS MEN IN OUR EMPLOY."

The business of this company is coal mining and coke making, and it is said to employ twenty thousand men ordinarily, and an immense number of engines, boilers, locomotives, pumps, motors, etc., are in use; and a very large force of men is required for their operation and maintenance. In order to reduce the number of accidents to a minimum, President Lynch, several years ago, sent four employees on an extended tour of Europe to study methods of preventing accidents used in countries whose casualty rate is less than in the United States. The result has been the adoption of many safety devices and regulations designed to prevent accidents.



GUARD FOR GEARS, BELTS, ETC.

The type of construction used for gear guards and cases, guards for belts, pulleys, etc., is worth noting, because of its simplicity and effectiveness. The material is usually No. 16 to No. 12 steel, notched and flanged cold, as shown in the accompanying sketch, and fastened with ¼-inch steel rivets, or smaller, headed down cold. As compared to a construction using corner angles, there are but half as many rivets to drive and holes to be put in, to say nothing of the saving in time and labor of bending angles. When desired, the resulting case will be grease and dust tight and surprisingly strong and rigid. Furthermore, no drawings are required and any ordinary mechanic can do the work with the simplest tools in odd moments. The result is a very neat, light case, easy to put on and take off.

"SAFETY FIRST" is the company's motto, and it will be found conspicuously printed wherever there is danger, or in places where the workmen gather or pass by in pursuance of their duties. It is also stamped on all stationery and meets the eye constantly in some form. Some machine shops that are full of death traps might well imitate the Frick company in providing similarly against accidents.

F. D. BUFFUM.

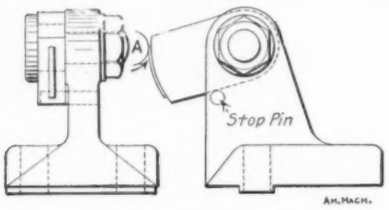
Scottdale, Penn.

Numbering Small Parts on the Automatic

Most small interchangeable parts, when made in large quantities, are given a part number, letter or symbol of some sort, and this number is usually stamped on the piece to facilitate the ordering of repairs and replacements.

This number in a great many instances can be put on when the part is made, thereby saving a slow hand operation, and at the same time giving a neater and more uniform numbering.

This can readily be done on the automatic in the case of screw heads, collars or spindles where one tool post is not occupied by a tool, and almost as readily



NUMBERING SMALL PARTS ON THE AUTOMATIC

where both tool posts are occupied, by a special tool post containing both the forming tool and numbering device.

Below is a method which can be used for numbering collars where one tool post is unoccupied, using, in this case, the back tool post.

In the sketch *A* is the work revolving in the direction indicated by the arrow. The cross slide moves forward and the numbering die, the first letter or number being in line with the center line of the work, coming in contact with the revolving work, is rolled upward till past the last letter or number on the die, when it simply lies over the work until the cross slide moves back when it drops down of its own weight to the stop pin let into the tool post.

Of course, this operation is being done while the turret is revolving or while any of the tools in the turret, which do not interfere, are working, thereby not requiring any extra time.

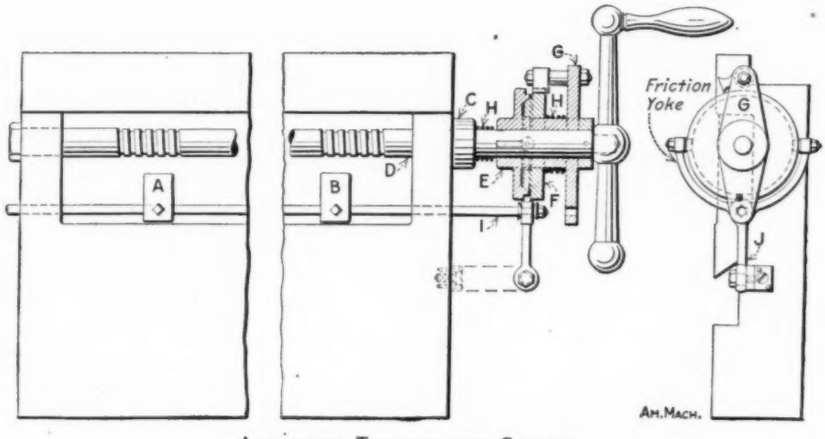
GEORGE T. WILSON.

Poughkeepsie, N. Y.

Automatic Trip for the Shaper

The cut shows an arrangement designed by me for automatically stopping the feed of a shaper anywhere within the limits of the cross-slide travel. It can be attached to any shaper without making any change in the screw of the machine. The friction knockoff blocks *A B* are first set to suit the piece of work to be machined, so that the feed nut in the cross slide will do the knocking off, by coming in contact with one or the other of these blocks. There is a collar *C* pinned to the screw *D* of the machine. This forms a stop for both frictions. The friction *E* is feathered a sliding fit on the screw *D* and drives the screw. The friction ratchet *F* is loose on the pawl lever *G*, which runs loose on the screw *D* of the machine. The pawl lever *G* and friction ratchet *F* are working constantly whether any feeding of the screw is going on on not. If the cross slide travels to the left the nut on the screw will come in contact with the friction knockoff block *A*, thus pulling the friction *E* out of engagement with the friction ratchet *F* and automatically stopping the feed of the screw. The same may be said if the cross slide travels to the right, the nut on the screw will come in contact with the friction knockoff block *B*, thus pushing the friction ratchet *F* out of engagement with the friction *E*.

The springs *H* are simply to return the friction *E* and friction ratchet *F* to their engagement again, ready for the next cut.



AUTOMATIC TRIP FOR THE SHAPER

The end of the friction releasing rod *I*, which enters the friction yoke *J*, should be barreled to allow for easy movement of the yoke *J*. As will be seen by the illustration only a very small amount of movement is necessary to disengage the frictions, thus stopping the feed. This arrangement will be found to give satisfaction on all classes of work, especially on machining gasolene-engine cylinders.

HAROLD E. MURPHY.

Westerly, R. I.

Plugging a Hole in a Ship's Bottom 14 feet Below the Surface

On page 519 there was an interesting letter on handling top and bottom ends (as we call them in Great Britain) of connecting rods, which must have been written by a sea-going man. I remember about 8 years ago reading in your paper in England some criticisms of marine engineers and their way, by a man who signed himself Amos Price, who said with regard to lubricating: "Land or stationary engineers should be sent to sea to instruct the uneducated sea engineers." Another gentleman (J. Turner, if I remember correctly) took him to task on his learned (?) dissertation on wrenches and the use of the hammer in setting up crank-pin ends. He deserved what he got. I've often wondered what he would have done if he had discovered (as we did) the circulating suction for the condenser, 14 feet below the surface, choked so that we could not get water. No use in talking about reversing the pump; we had no connections for blowing a jet of water through.

I got a board, weighted it at the bottom and on one side nailed a bag stuffed with some soft stuff; slung this with a rope top and bottom over the stern of the ship down below the hull and walked forward to where we figured the inlet was. We then slackened off the valve cover and adjusted the board to keep the water out. Everything was easy then with our imitation collision mat. The board was to prevent the bag being forced in by the pressure of the water.

Detroit, Mich. J. C. PAGE.

The Old Grindstone for High Speed Steel

We had our troubles with high-speed tools much the same as several of your correspondents. Soft wheels, run dry, were tried, but did not satisfy entirely. One day the repair hand was told to get the old grindstone out of the shed and set it up in the basement to run at a peripheral speed of about 3000 feet per minute. After running it there a month, giving an opportunity to try it out, it was placed in a good position for light, convenience and comfort on the machine-shop floor. It is trued up twice or thrice a week with a Huntington emery-wheel dresser, keeping it in good condition, and thus far results have justified the resurrection.

South Acton, Mass. I. K.

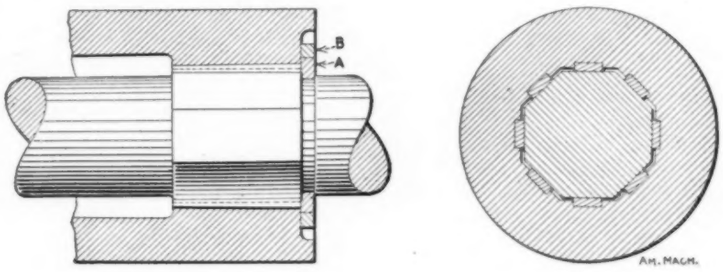
Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Forcing Sugar Mill Rolls on Their Shafts

I was very glad to see Mr. Colvin's article on "Sugar Mill Rolls," on page 922. As I have had considerable experience in sugar machinery, I agree with Mr. Colvin when he says it is one of the most interesting branches of engineering. It is a subject that is very seldom discussed in the engineering journals and publications, so I was the more pleased to see the AMERICAN MACHINIST delve into it, and hope the traveling editors will find some more interesting features in their wanderings.

In contrast to the method of forcing the rolls on the shafts, as used by Bancroft, Ross & Sinclair, I would like to show one method used in a shop where I was employed.



FORCING SUGAR MILL ROLLS ON THEIR SHAFTS

This shop, in its day, has probably built more sugar machinery than any shop in the country, but during the last 10 or 12 years has lost most of its trade in this line. So that all the rolls made in recent years were for repair orders, and came to us through commission merchants or plantation agents. As drawings were usually furnished us, we followed them in securing the roll to the shaft, which was usually done with keys.

I can readily see that forcing the roll on would be far cheaper and just as satisfactory as the method I am about to describe, but had we wanted to, we could not have forced the rolls on, as we had no press large or powerful enough.

The engraving shows one method that was quite common. One end of the roll is shown, and both ends were quite alike so far as the fastening of the roll to the shaft was concerned.

The shaft was planed octagonal where it fitted in the roll, which was planed out to correspond with about one-half inch clearance. Keyways were cut in the roll only. After the keys were driven in, the ring *A*, which was in halves, was placed in a groove turned in the shaft. Then ring *B*, which was in one piece, was shrunk on. These rings prevented the keys from backing out. After this had been done, the roll and shaft were placed in a lathe, and the roll turned and ground.

Often the shafts would be hexagonal or square, where they fitted in the roll, and the same method of keying was usually employed.

Sometimes the roll had to be shrunk on the shaft, and this was somewhat dreaded, as it was inconvenient to do.

The roll, after being bored, had to be taken in the foundry, stood on end, and a huge bonfire built about it. When it had expanded enough, the shaft was taken up by an electric traveling crane and let down in the roll. There was always considerable suspense until the shaft was all the way down. Once there was some delay in lowering and the roll shrunk tight when the shaft was about half way down.

The shop referred to is that of J. B. & J. M. Cornell Company, at Cold Spring, N. Y. The Cornell company in 1897 took the plant of the West Point Foundry, which was established in 1817. The West Point Foundry had turned out an enormous quantity of sugar machinery, but the Cornell company lost a great deal of the trade, although it built several complete sugar plants.

ARTHUR N. PATTERSON.

Cold Spring, N. Y.

How Machines Are Designed

The article, "How Machines Are Designed," by Entropy on page 494, was indeed interesting. The subject is surely broad enough to accommodate all who have a desire to express their opinions on it.

Modern design consists chiefly in taking some old design and making such changes or additions as are necessary to meet the new conditions, so that a draftsman or designer to be of the most benefit to his employer, must know what has been done previous to that time along the line of manufacture upon which he is working. Failure to acquaint himself with this information may cost the employer considerable money and the employee the chances of promotion.

The value of knowing what has been done before is well brought out in the design of railway cars. For instance, the U. V. R. R. gives an order for 500 gondolas of 40 tons capacity, specifying certain over-all dimensions, material, make of air brake, kind of draft rigging, etc. The well informed draftsman will know as soon as he reads these specifications that this car, with the exception of a few details, is like the X. Y. Z. gondola built a year before. This simplifies the work so that it becomes almost entirely a tracer's job. Car after car is designed in this way. Some car built before is simply gone over and changed to suit the conditions. In one case an order was worked up for a certain flat car, when the only change that was necessary in order to use a car built some time before for another road, was to make use of a different style of center plate.

CHANGING OLD MACHINES IS NOT REALLY DESIGN

Of course, this work of merely changing old machines is not really design in the proper meaning of the word. In cases of real design it is necessary to have a "starting point" as suggested by Entropy, and work from that. The working up of dies for pressing steel plate to be used in steel-car or similar construction, supplies plenty of opportunities for the designer to exercise his originality or ingenuity. Almost every die must be designed to meet special conditions. The "starting point" is, of course, the surface of the die that comes in contact with the metal to be pressed, and from this point the designer works back to the surface that rests on the press. Usually a section of the shape to be formed is first laid out, and then the top and bottom

dies are built up around it, after which the remainder of the die is laid out, the hight being limited by the minimum distance between the press faces when in operation. This work appeals to draftsmen because of its chance for originality, and it is indeed a pleasure, especially for a young man, to go into a shop and see large steel shapes being pressed by dies designed by him.

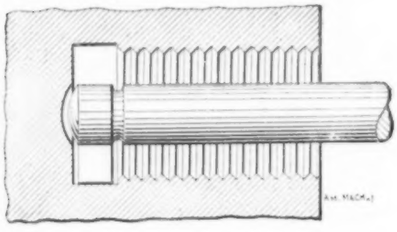
From experience in drafting rooms it becomes obvious that machines, large and small, are built after some previous design with a few new added features from time to time, and that original design from the ground up is limited. A few years ago in the ordnance drafting room at Rock Island arsenal, Rock Island, Ill., about sixteen draftsmen and designers were employed, and one man took care of practically all of the real design, while the others worked up apparatus from old drawings. While this is true in nearly all drawing offices, yet it should not discourage young draftsmen, for the man who knows his particular line of work and can get up something new from an old design, seems to stand as good a chance nowadays as the one who labors over his slide rule and hand book. Success seems to be with the man who knows the business rather than with the one who knows calculus.

S. H. YORKS.

That Undercutting Tool

On page 992 you illustrate an undercutting tool to be used in holes that are to be tapped with a bottoming tap.

Professor Sweet, who wrote that article, called my attention to such a tool in his shop probably 25 years ago; since which time this company has always been ready to make them for anybody who wanted them, and we have illustrated them in our catalog, as shown herewith.



UNDERCHTTING TOOL

The CLEVELAND TWIST DRILL COMPANY,
J. D. COX, president.

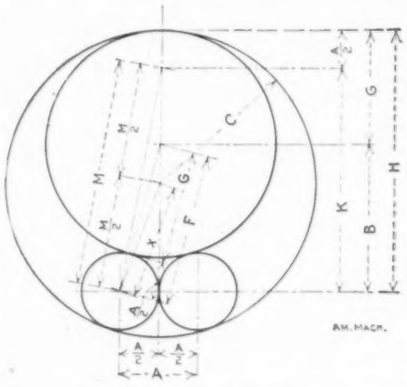
Elliptical Gears with Central Bore

Referring to an article under this title, printed on page 774, Prof. W. H. Rasche, of the Virginia Polytechnic Institute, has called our attention to an exact method of laying out the true rolling curves of such gears. This method Professor Rasche described in an article in the AMERICAN MACHINIST, page 120, Vol. 23.

The Ring Gage Problem

Referring to Mr. Johnson's solution of the "Ring Gage Problem," page 510, I should like to say that I had occasion, about two years ago, to solve the same problem.

I think the solution as herewith presented, while omitting the reasoning, is much simpler and in better shape for use



THE RING GAGE PROBLEM

and probably would appeal more strongly to those not so well acquainted with trigonometry. You will notice that the solution does not involve anything more than the "fundamentals."

Given A and B, to find the radius of the large inscribed circle G, and the radius of the circumscribed circle C.

$$\sqrt{\left(\frac{A}{2}\right)^2 + B^2} = F$$

$$F - \frac{A}{2} = G$$

$$G + B = H$$

$$H - \frac{A}{2} = K$$

$$\sqrt{K^2 + \left(\frac{A}{2}\right)^2} = M$$

$$\frac{M}{2} : x :: K : M$$

$$x + \frac{A}{2} = C$$

JOS. B. ABELE.

Clifton Hights, Penn.

Utilizing Oxygen in the Blacksmith Shop

The note at the foot of page 947 about conserving the heat of a bar that is being forged, by a jet of compressed air blown against the end of the bar, brings to mind the time when as a small boy, I was allowed the run of a blacksmith shop in the neighborhood, part of the output of which was horse-shoe nails, made by hand, in which the compressed-air trick was used for that purpose.

A small bellows was mounted behind the anvil with its nozzle located very close to the end of the heated bar and operated by the smith through a foot treadle. I asked the smith why he blew cold air against the hot iron, and he said to keep the iron hot, that without it the bar would get cold before he got the nail finished, but why it did so he could not tell, and the riddle was not solved for me until I had seen a bessemer converter at work, when it was plain enough that the combustion of the oxygen in the air was responsible for heat enough to keep the heat of the bar from being dissipated to the air.

ALONZO G. COLLINS.

Philadelphia, Penn.

Scaling with the T-Square

I wish to commend the article by James Stone, on page 506, relating to an indexed T-square and drawing board. I have used practically the same thing myself when doing work at home, with a consequent big saving of time and annoyance. I merely glued strips of paper, divided into inches and fractions of inches, to the edges of my board and T-square, with a smooth coat of white shellac afterward to protect it. The saving of time is more noticeable when working with an ordinary T-square, but the idea can be applied to a pulley-type drawing board equally as well.

R. A. RUDOLPH.

S. Norwood, Ohio.

Drilling Holes in Thin Plate

When an occasional hole has to be drilled in soft plates 1/64 and less in thickness, ordinary twist drills do not make a good job.

A good way to get over the difficulty is to use an ordinary carpenter's center bit, driving it backward, and placing a piece of wood under the work to receive the center of the drill. Holes drilled by this method are surprisingly clean.

When a number of similar holes are required the wood-cutting lip can be ground off and the drill driven forward.

J. MC KECHNIE.

New Brighton, England.

The number of power motors manufactured annually increased, according to the Census report just issued, from 35,604, valued at $7,551,000 in 1899 to 79,877, valued at $13,121,000 in 1904, and to 244,123, valued at $18,306,000 in 1909, there being an increase of 586 per cent. in number, and 142 per cent. in value for the decade. Many powerful motors were manufactured, but the number of small motors has increased so rapidly that the average capacity per machine has declined; the average horsepower per motor for the three census years being 14.5, 8.5 and 6.7 respectively.

Double-Cutting High-Speed Planers*

By J. Hartley Wicksteed†

The advantages of double cutting are: Two feeds per cycle, reduced wear of the tool per unit of surface machined, and mutual assistance of the tools in chipping away scale where each tool enters.

Wide, slow-speed belts are advocated, also the use of a reaction spring to aid reversal of the table.

A 5-foot x 16-foot machine embodying these features.

*Abstract of a paper presented to the British Institute of Mechanical Engineers.

†Director, Joshua Buckton & Co., Leeds, England.

The recent development of change-speed reversing motors has overcome the chief objection previously existing to the extended use of the double-cutting principle in planers. The previous objection to the use of a double-cutting tool box was that, with an equal speed to the table on both the forward and backward cut, it followed that, when the work did not permit of the use of both tools for want of clearance at the end of the stroke, as, for instance, when planing in a steam chest, and when therefore only one tool could be used, the absence of a quick return-motion on the idle stroke discounted the advantages gained on other work where double cutting could be employed. The variable-speed reversing motor removes this objection, because this drive can be set either to reverse at equal speeds for double cutting or to drive slowly on one stroke and quickly on the other, whenever it is convenient to plane only in one direction. Thus, in the machine illustrated in Fig. 1, which is a Buckton double-cutting planer to plane 10 feet square by 30 feet long, driven by a 30-horsepower Vickers reversing motor, with an auxiliary 3-horsepower motor for raising the cross-rail and side heads, and for feeding and traversing all the heads; the table is driven at speeds varying between 20 and 60 feet per minute on either stroke.

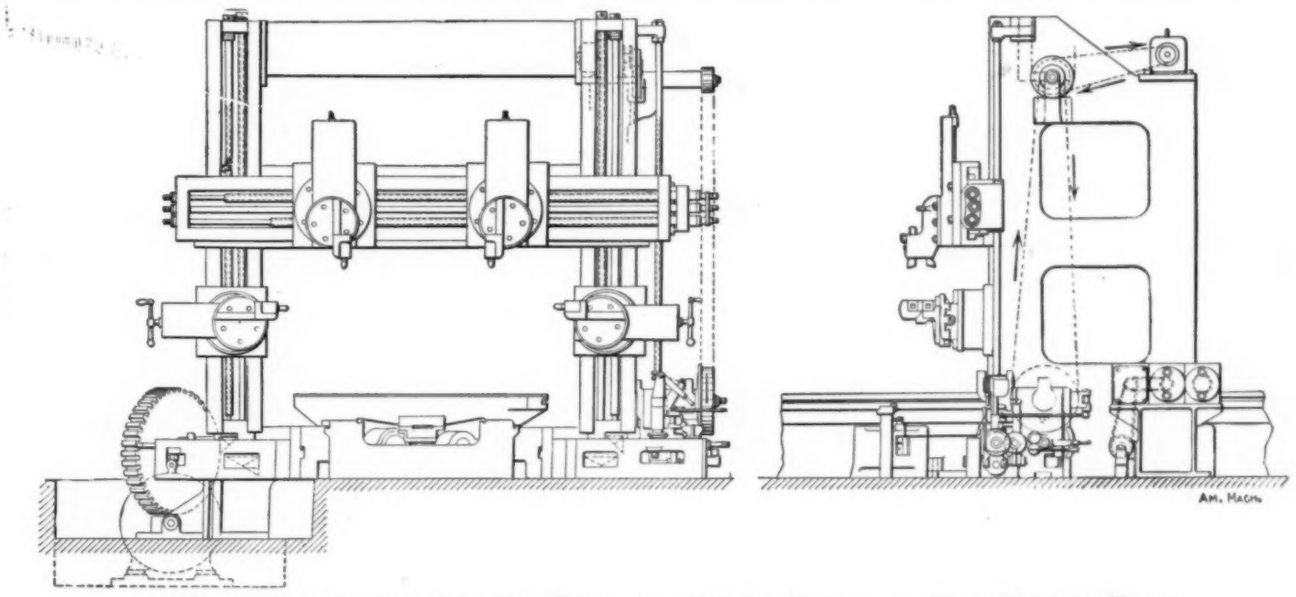


FIG. 1. BUCKTON DOUBLE-CUTTING PLANER, 10x10x30 FT., DRIVEN BY A 30-HP. REVERSING MOTOR

The motor is regulated by varying the field strength, and will stand heavier intermittent loading at the lower speeds than at the higher. Hence, this motor will exert its full horsepower at all speeds, as the torque on the motor shaft is approximately inversely proportional to the speed. The result of this is that the slower the speed the table is driven, the heavier is the cut that can be taken. In general, the machine cuts on both strokes, but the double-cutting tool holder can be removed and a strong single tool holder substituted, capable of carrying a long projecting toolstock for heavy cuts on steel, in any case where the work does not lend itself to double cutting.

ADVANTAGES OF DOUBLE CUTTING

In planing cast iron the advantages of double cutting are twofold; for, besides having two feeds to the head on each cycle of the table, the back-to-back tools mutually assist each other by chipping away the scale in front of them in either direction, so that each tool has clean metal to enter at all the edges of the casting with which it comes in contact. The tools are thus saved from so much wear that, instead of two tools requiring more fixing, they require, on the whole, less fixing than a single tool, for the reason that the back-to-back tools so save each other from wear that they do not need to be removed and refixed during the progress of the work, for the purpose of being reground. Also, the first roughing cut is more uniform if made with two tools than with one tool, because they get so much less worn between the first cut and the last, partly because each tool only takes alternate cuts, thus reducing the wear to half what a single tool would be subjected to on one job and with one setting; and further, because of the assistance which each tool has rendered to its companion in preparing clean metal at all the edges where the single tool would have had to face hard scale. It has accordingly been found that turbine casings, for example, could be planed true in less time by double than by single cutting, even if the time taken by the idle return stroke were eliminated altogether The reverse position of the back tool also makes it particularly advantageous for taking broad finishing cuts; it does not require cranking back to prevent making chatter marks, because it has no tendency to dig into the work. For the same reason it can be advantageously used for cutting grooves with a parting tool. In these cases, although the double-cutting tool

holders are not changed, the back tool only is inserted and the back stroke can be driven at 20 feet per minute, with an idle stroke, on the usual forward stroke, of 60 feet per minute. There are also occasions where it saves turning the work round end for end to have a tool available for planing up to an obstruction in either direction.

The feed of the heads is effected by a continuous running belt pulley and a friction clutch, which is thrown in at each reversal of the machine, and permits the belt pulley to take one, two, or four complete revolutions before it is thrown out. Further changes of feed are provided in a gear box. If one tool alone is in action, the lever at one end of the table is turned back so that the feed does not operate on that reversal.

The manner of double cutting is to fix both tools precisely back to back; in fact, the second tool is adjusted by simply dropping it into the furrow made by the first tool. The back tool follows in this furrow till the end of the stroke when it receives a feed motion; it then cuts a further furrow in which its companion follows free, and thus, on a single cycle of the table, two furrows have been cut of equal width and equal depth. Thus, assuming a feed of ⅛ inch at each reversal, then at the completion of the cycle ¼ inch would have been traversed.

It is astonishing to me to see any machines put down for the express purpose of planing engine base plates, machine beds, table or tank plates, with an idle return stroke, even if provided with gang tools, when two back-to-back tools would do all such work with much greater economy in the wear of the cutting tools, the wear and tear of the machine, cost of driving power, the time of doing the work and the quality of the work done.

It must be conceded, however, that for work of great variety, and in some cases for special work, the bulk of it may only lend itself conveniently for cutting in one direction, and therefore the saving of as much time as possible on the idle stroke is very advantageous. For instance, in planing railway switches, with heavy cuts on very hard steel, it would be dangerous to enter a tool in the direction of facing the point, and consequently this special work is done cutting on one stroke, and the quickest possible idle return. Also, in miscellaneous work fixed to the table by clamps and bolts which often project above the work and would interfere with the 6-inch over-run of the back-to-back tools, there are advantages in cutting in one direction only. The consequence is, that on machines of moderate size, where it is practicable to get a quick return of about 8 to 1, it is hardly worth while to have a double equipment of tools and tool holders, especially as on short jobs requiring right- and left-hand tools for planing down vertical faces, or for undercutting, or for rounding the corners of the work, the single-cutting head would be almost constantly in use.

A Reversing Motor Driven Machine

One machine that I wish to mention has tandem tables, each of which will separately plane 16 feet long by 5 feet wide by 5 feet high. It will cut at any speed from 17 feet per minute to 60 feet per minute, and return at 136 feet per minute. It is driven by a 50-brake horsepower electrical set, as made by the Lancashire Dynamo and Motor Company, Ltd.; the motor-generator is placed upon the top of the machine and runs at a constant speed. The motor is driven from the mains and can be either alternating or direct current. The generator supplies current to the planer motor, the voltage of which is varied, thus giving changes of speed on the machine over a total range of 8 to 1. The machine will take the same strength of cuts at any speed from 17 feet to 60 feet per minute, the horsepower given out by the planer motor being directly proportional to the cutting speed.

A Belt-driven Machine

The next machine to be described is of exactly the same strength as the foregoing, and it gives the same weight of cut at slow speeds and has the same high ratio of quick return; but, instead of being driven and reversed by a reversing motor, it is driven either by a belt from the line shaft or by a continuous-running motor.

Fig. 2 shows such a machine to plane 16 feet by 5 feet by 5 feet, driven by a 30-horsepower motor running at 600 revolutions per minute, whose power is delivered through belts to the machine. The belts do not shift on fast-and-loose pulleys but are themselves tightened and loosened alternatively, and when at half stroke of the jockey pulleys each runs loosely in a loop under its respective pulley without touching it. The cutting speeds are 17, 35 and 60 feet per minute, and the return speed 136 feet per minute. The machine has a self-contained countershaft, which may be belt or motor driven, and two open belts, as has been said, to convey the reverse motions to the cutting and return strokes. One belt for the quick return is driven from the countershaft or motor spindle, the other belt for the variable cutting stroke is driven through a three-speed gear box. The gears run in oil and only one pair is in mesh at a time, namely, the pair giving

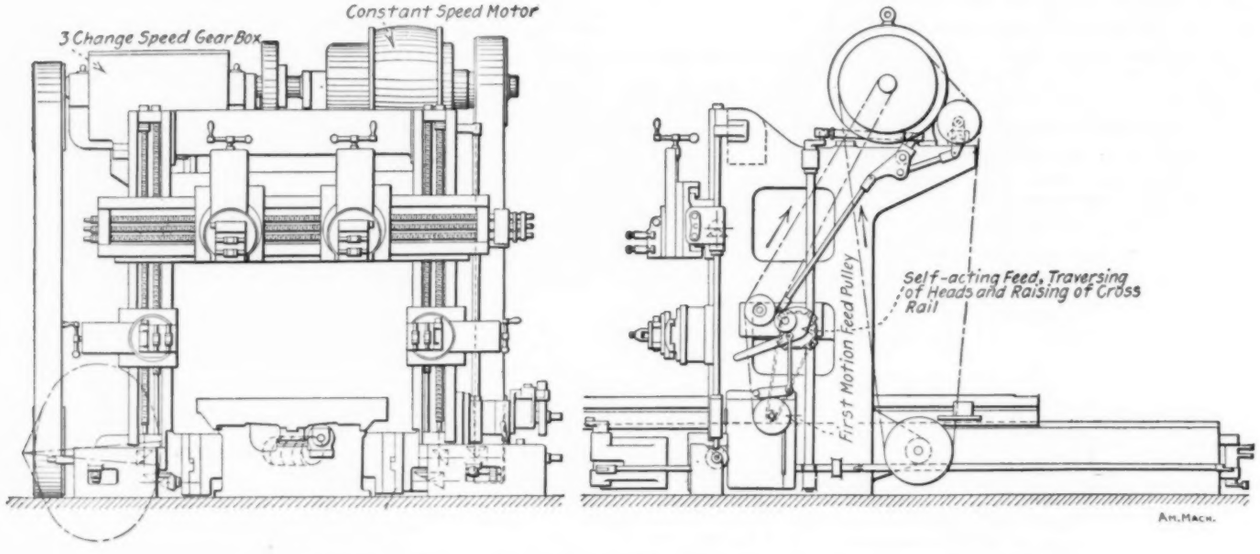

Constant Speed Motor
3 Change Speed Gear Box
First Motion Feed Pulley
Self-acting Feed, Traversing of Heads and Raising of Cross Rail
Am. Mach.

Fig. 2. Buckton 5x5x16-ft. Planer, Belt Driven from Constant-speed Motor

the speed required for the cut in use. On account of the drum of this belt being driven through single-purchase gearing, it runs in a contrary direction to the quick-speed belt, and therefore it reverses the machine without being crossed, which enables it to drop plumb round its pulley. Each belt incloses a jockey pulley (idler). The pedestals for the jockey pulleys are adjustable so that a good endless belt never requires taking up and joining. Both jockey pulleys are thrown from the same rocking shaft, and when the reversing gear rocks this shaft in one direction the driving belt is tightened by its jockey pulley, and when it rocks in the contrary direction the driving belt is loosened and the quick-return belt is tightened. The belts are endless belts from the makers' works without any laced or metallic joints, and any stretch that ensues in a new belt is taken up by moving the position of the jockey pulley. The grip of these open belts is so smooth upon their pulleys that there is not the slightest knocking on the gearing, at the reversals of the machine. They themselves form a most perfect friction-brake drive, and no cushioning device or friction coupling is required to prevent knock at reversal. The belts are 8 inches wide, and as they are not subject to contrary flexure round the jockey pulleys, and encounter no edge friction from the belt striking the forks, they are exempt from the elements of self-destruction usually found in heavy planer belts.

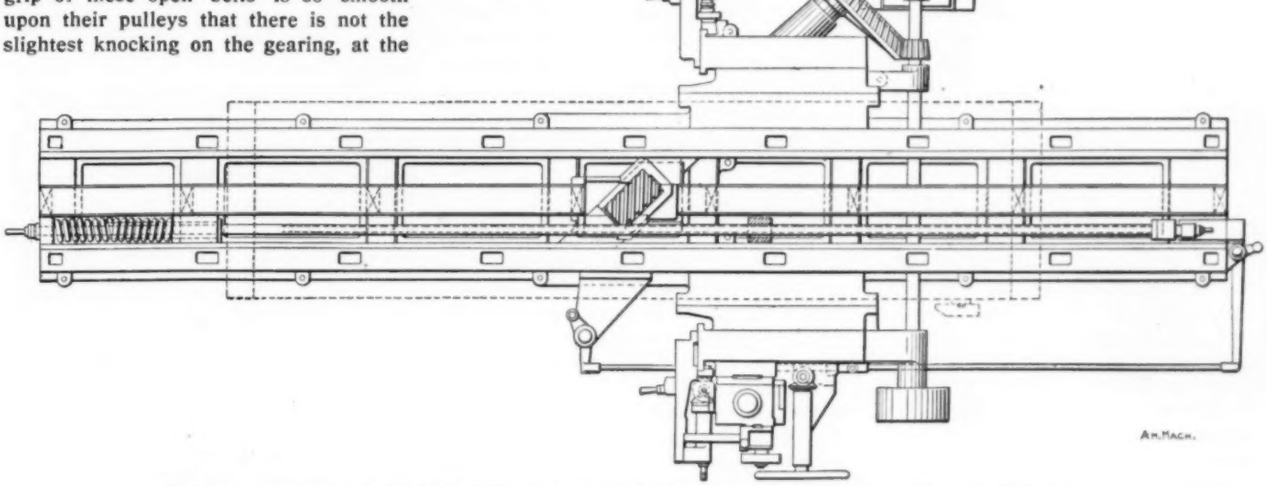


FIG. 3. ARRANGEMENT OF REACTION SPRING FOR HIGH-SPEED RETURN OF PLANER TABLE

WIDE, SLOW-SPEED, VS. NARROW, HIGH-SPEED BELTS

It is, perhaps, needless to say that the chief inertia in stopping or starting a belt-driven planer resides in the rim of the driving pulley. During the quick return stroke the shaft of this pulley makes about 800 revolutions per minute, and it is obvious that if this shaft be driven by a pulley 24 inches diameter with 8 inches face, instead of a pulley 48 inches diameter with 4 inches face, the weights of the pulley rims would be about the same. But the peripheral speed of the one would be twice that of the other, and the inertia to contend with in the larger-diameter pulley would be four times that in the smaller-diameter pulley, although the belt-driving power would be the same. Therefore, by using broad belts of low velocity instead of narrow belts of high velocity to deliver the power of the motor onto the cut, the chief inertia has already been reduced enough to enable the return speed to be double without increasing the inertia of the pulley rim. Incidentally the broad, slow belt is a better brake than the quick, narrow belt on account of its broad surface and low velocity.

I do not claim to have discovered the advantages of the broad, slow belt for reversing pulleys. That principle was first introduced by W. C. Mitchell, and has been applied by him to many heavy planers. His system is that of tightening and loosening belts by jockey pulleys acting upon the outside of the belts, and the chief difference in my system is that the jockey pulleys act upon the inside of the belts and that the rocking shaft which works them is rocked from a crank pin semi-revolving, so as to reach opposite dead centers at each reversal. The same system of a loose belt tightened from the inside is also applied to the feed motion. When the handle of its jockey-pulley frame is lifted, the feed motion runs continuously for traversing the heads and for raising the cross rail. When the handle is dropped the continuous motion ceases, but when the machine is running, a lever from the rocking shaft, which throws the main jockey pulleys, pulls a pawl lever engaging into the frame of the feed-motion jockey pulley, and thereby tightens the feed belt, just at the end of the quick-return stroke; but as soon as this tightened belt has driven the first motion of the feed gear one revolution, it has also turned a stripping disk one-fourth of a revolution, stripped the pawl out of engagement, and allowed the handle to drop, loosening the belt, and, at the same time, pressing a brake upon the feed pulley to prevent over-run and has given a feed of $\frac{1}{32}$ inch. The stripping disk has four wipers, which, when all are in operation, strip the jockey pulley after the first-motion feed wheel has made one revolution.

The wipers can be turned down, and, when only two are left in action, the feed pulley receives two revolutions before the pawl is lifted and the feed becomes $\frac{1}{16}$ inch; and when only one is left the feed pulley receives four revolutions before the pawl is lifted and the feed becomes $\frac{1}{8}$ inch. But the first-motion feed pulley drives through two change gearings, and when the quicker gear is thrown in, the feeds obtained from the stripper plate become $\frac{1}{4}$ inch, $\frac{1}{2}$ inch and 1 inch. By this simple automatic gear, therefore, six rates of feed are obtained varying from $\frac{1}{32}$ inch to 1 inch. The heads can be traversed without altering any clutches.

For example, assuming that a feed is operating upon one of the heads and that, to pass over a part that does not require planing, it has to be traversed 12 inches to come up to its fresh cut, then, without making any change in the feed gear, but by simply holding the jockey pulley into the belt by its hand lever, the motion becomes continuous instead of intermittent; but the moment the hand lever is dropped, the intermittent feed motion is resumed. The direction of traverse is reversible by a handle. All the feed motions and the traversing motions of the heads and the raising and lowering of the cross slide are effected by power from this same continuous running belt. The table is driven through a rack by Sellers' spiral gearing. The guides of the table and bed are flat horizontally

and slightly undercut at the sides. The table therefore cannot lift under any circumstances.

Use of a Spring to Aid Reversal

The plan view of this machine, Fig. 3, shows the arrangement of a reaction spring placed in the bed of the planing machine, which enables it to attain the speed named without distress upon the return belt or overload upon the prime mover. It will be seen from the drawing that there is a boss cast on the second cross-bar at the front end of the bed, and abutting against this boss is a helical spring about 2 feet long. Through this spring a screw shaft is passed carrying a collar to press against the outer end of the spring, and also carrying a heavy nut against which a lug, cast solid under the table, impinges.

By turning the screw shaft, the nut can be traversed over a length of 16 feet into any position desired for the reversal of stroke. When the lug under the table impinges upon its nut, it moves the screw shaft endways, and by the collar at one end compresses its spring. On one end of the screw shaft a cam plate is carried on a crosshead, and the end movement of the screw carrying the cam plate with it moves the lever of the belt-striking gear, and thus the same movement of the screw shaft compresses the reaction spring and reverses the drive. The synchronism of these two operations is not disturbed by turning the screw round and altering the position of the nut to adjust the length of stroke, and this can be done even while the machine is in motion. The place at which the table ends the cutting stroke always corresponds with the position of the nut, namely, anywhere over the 16-foot range of the screw shaft. The screw is 1-inch pitch, which is convenient when the operator is setting the stroke for exact clearance, as each full revolution of the screw alters it a known inch. The screws can be turned by hand so rapidly that an adjustment over a range of 10 feet can be effected in 1 minute. At the end of the screw shaft, passing through the spring where the cam plate is placed for reversing the table from the cutting to the idle stroke, it will be seen that there is a little space between the cam plate and the belt-striking lever. This is to give a late cut off to the belt-striking gear so as to prevent the driving belt being loosened before the spring is sufficiently compressed. While the cam plate is passing through this space on the 60-foot cutting stroke it is compressing the spring, wholly by the residual energy of the moving masses, and when the space is covered and the lever kicked the spring has made a dead beat of 4 inches. The scale of this spring is 1 ton per inch, giving a terminal pressure of 4 tons.

Thus, at the end of each cutting stroke, the spring being compressed 4 inches, there is, at the moment of the table reversing, such a thrust upon it as will help to start it on its quick-return journey. The quick-return belt is thereby greatly relieved, as it is not called upon first to take out the kinetic energy of the table and the revolving pulleys in one direction, and then to supply a further amount of energy to accelerate them in a contrary direction, but, instead of this, the whole of the residual energies of the revolving parts and of the moving table at the end of the cutting stroke are stored up in the spring and are immediately returned, by its reaction, to assist in starting up the quick-return stroke.

When the speed of cutting stroke is 60 feet per minute, more than the necessary amount of work is supplied to compress the spring by the kinetic energy of the moving parts, but when the table is driven at its slowest speed of 17 feet per minute a little assistance is required from the drive at the end of the cutting stroke to complete the compression of the spring. Seeing, however, that the drive is from a constant-speed motor and acts through 3½ times the multiplying power of the gear when the cutting speed is at its slowest, it happens that at the very time when there is a deficiency of energy in the moving parts for the complete compression of this spring, there is a surplus of power in the drive, beyond what is required to complete the maximum cut, without putting any overload upon the motor. By the reaction of the spring described the table has a good sendoff at the beginning of the quick return stroke, and no dwell is perceptible at the point of reversal; there is no shock on the gearing, and the curve of the power diagram does not rise above the full-load line. In starting up the quick-return motion the short spring delivers 0.66 foot-ton of energy in 0.26 of a second, which is at the rate of 150 foot-tons per minute, which is at the rate of 10 horsepower during the period of acceleration.

The following detailed description will explain the action of the spring. Picture, then, the table ready for starting its return stroke under the influence of a spring compressed to a load of four tons and stored with 8 inch-tons of potential energy, which, being regulated by the speed of the return belt, it delivers to the tables in 4 inches of travel. The 30-horsepower quick belt with this assistance is able to accelerate the table, and keep the speed up throughout the stroke, without heating the pulley. The machine will at all times work dead beat between two walls, and plane up to ⅛-inch landing.

The reversal at the end of the quick-return stroke is dealt with quite satisfactorily by the broad belt on the 24-inch driving pulley, and this belt motion is struck from the usual form of dog on the table.

The machine will work with certainty at full speed and let the tool drop without marking the work between landings of 3/16 inch for the start and ⅛ inch for the finish. The reduction in idle clearance spaces and the command of good feed traverses, ranging from 1/32 inch to 1 inch, contribute greatly to the large output of work which has been realized with this machine. By this system of drive with continuous-running prime mover, the full power of the drive is available at all speeds, and the heaviest chips can be taken at the lowest speed.

The power of the machine, as described, is equal to a 10-ton pull upon the table at the middle speed, and a 15-ton pull at the slow speed. The speeds given are such as could be worked continuously without heating or irregularity down to 12 inches length of stroke, and if made without a reaction spring, the return speed, instead of being 136 feet per minute, would be 110 feet per minute, but if it were driven by shifting belts and without reaction spring, 90 feet per minute.

It will be readily understood that in proportion as machines are made for lighter cuts, they can be returned at quicker speeds, because, as has been said before, the chief inertia lies in the rim of the driving pulley, and this rim must needs be made in proportion to the weight of the cut required. Thus, in a 4-foot-square machine, with a 5-ton pull on the table, fitted with a reaction spring, the quick return of 160 feet per minute can be given, or in a quite simple machine for light cuts, with about 1-ton pull on the table, a return speed of 240 feet per minute is attained without the assistance of any springs. On the other hand, it should be borne in mind that, in a machine for extra heavy cuts requiring a 20-ton pull upon the table, the judicious return speed would be less than those quoted in proportion as the power might be greater.

The figures of the Bureau of Statistics, Department of Commerce and Labor, show a marked change in the trade movements of tin plate. The October imports and exports, stated in quantities, during the last three years are as follows:

October	Imports, Lb.	Exports, Lb.
1909	11,117,035	1,414,110
1910	3,737,997	1,236,141
1911	1,286,877	15,941,893

The marked decline in imports during the last two years, as explained in a statement recently issued by the Bureau of Statistics, is due to the high price of tin plates in foreign countries, coupled with relatively lower prices in the United States. In October, 1911, the average import price of tin plates was 3.8c. per pound, against 3.2c. in October of last year, and 2.7c. in October, 1909.

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Of this issue 22,500.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 145

American Machinist

Modern Apprenticeship

We have often urged the importance of an apprenticeship system, adapted to modern conditions, as an effective and economical way to train skilled workers in the trades. Fifteen years ago we made an extended investigation into the practice of machinery builders as regards apprentices and classified and published the results, which showed that even then more was being done to systematically train boys for the machinist's trade than had been commonly realized.

Since that time the apprenticeship system has been growing more in favor among some manufacturers and has been constantly strengthened by the adoption of such methods as to adapt it to modern needs and conditions. This has been brought about by providing auxiliary training by means of school work made a regular part of the apprenticeship course and by more systematically moving the boys from one department or machine to another so that no matter how much the shop is specialized the apprentices will become familiar with the various machines and operations. Such auxiliary-school training proves of special value when it is of such a nature as to enable the boys to make use of the mathematics required in their trade and present their own ideas by means of free-hand sketches and mechanical drawings as well as in writing and conversation. This correlation of shop and school work is taking many forms and should be carefully studied to secure the greatest advantages attainable from such a course. The possibilities in this direction are just bginning to be understood and the whole matter of apprenticeship is being strengthened by its intelligent use by many manufacturers and by the indorsement by bodies of such standing as the National Machine Tool Builders' Association and the National Metal Trades Association. Such indorsement augurs well for its continuance, growth and further usefulness.

We believe that, at least for a long time to come, a large proportion of the skilled help of our shops must be developed in the shops themselves, regardless of all that may be done along the lines of industrial education as conducted in the schools; and we fully believe that there is no better way to insure that development along satisfactory lines than by means of a thorough system of apprenticeship.

Some essentials for such a system of apprenticeship are a definite agreement for a term of years at fixed wages; competent oversight by an instructor in addition to that ordinarily given by the foremen; a definite schedule of the kinds of work and time of the transfer to the various departments to give experience in all branches of the trade; and practical school training during working hours and for which the apprentice is paid his regular wages and is under shop control and discipline.

Safety Inspection in Shops

At the recent convention of the National Metal Trades Association, the committee on Systematic Compensation for Industrial Accidents urged the appointing of a safety inspector by the association. After a thorough discussion on the floor, the following resolution was adopted:

"Whereas: The question of systematic compensation for industrial accidents is receiving wide attention in this country; and

"Whereas: The matter of the prevention of such accidents is of the first importance and demands the greatest consideration by all employers; be it

"Resolved: That this convention of the National Metal Trades Association recommends to its administrative council the consideration of a plan for the inspection of the shops of its members, which plan will furnish to the members themselves an opportunity of judging the comparative state of their own equipment and system for the preservation of human life; and will show the association what progress, if any, may be made, from time to time, in the furnishing of adequate safety devices; and be it further

"Resolved: That the administrative council be authorized to appropriate the funds to a reasonable amount to make such inspection, if upon their investigation the plan appears feasible."

Action has already been taken; an inspector has been appointed in accordance with the terms of the resolution and his work has begun.

This is a commendable act on the part of the association. The position of this inspector holds forth the possibility of doing much good. He can become a clearing house, through which all of the successful safety devices originated in the shop of one member can be passed on to the others. This will tend to bring about uniformity among the various shops with which he comes in contact, and will raise their equipment to a higher plane of safety as his suggestions are adopted and put into effect.

This is constructive work in the prevention of industrial accidents. May such good work go on!

A Severe Loss to the Navy

Readers of the AMERICAN MACHINIST are familiar with the name, writings and work of Naval Constructor Holden A. Evans. They will be surprised to learn that he has resigned from the Navy and will leave the service on Jan. 1 next. He will become vice-president of the Moran Shipbuilding Company, of Seattle, Wash.

For the past three years Constructor Evans has been the foremost man in the Navy, in his demand for the proper organization and management of the shops and yards under the control of the department. At Mare Island he made an enviable record for himself.

It is a great mistake that such a man should be allowed to leave the service, especially as the need of Navy Yard reform is so apparent and pressing. Instead of being allowed to resign, he should have been selected as the one man to undertake the great task of reorganizing the yards and getting them on a basis of proper management.

The fact that he will leave on Jan. 1 but once more emphasizes the inefficiency of existing conditions. We are confidently looking forward to a thorough investigation of Navy Yard affairs by Congress. With our present knowledge of manufacturing processes and methods,

factory organization, accounting and shop management in general, there is no excuse for the department, in not taking advantage of all of these in the administering of Navy Yard affairs. Congress will undoubtedly ask "Why?"

While Constructor Evans has been lost to the Navy, he has not been lost to the forces for Navy Yard reform. It is possible that he will be able to do more for the cause to which he has been devoted when outside than when inside of the service.

Examination for Assistant Shop Superintendent

On Jan. 8, 1912, an examination will be held at the United States Navy Yard in Philadelphia, Penn., for filling the positions of one assistant shop superintendent in the hull division, and one assistant shop superintendent in the machinery division. The pay is $5.04 per day. The examinations will be practical in character, having particular reference to the requirements of the positions to be filled.

This is a good opening for a young man who has had a fairly good education and a few years of practical experience in the shop. The shops of the Philadelphia yard are being constantly improved, and some of the work by the men who will get these positions will be in connection with working out shop arrangements, toolroom arrangements, methods of handling material and tools, planning work, and the like.

Application must be made to the Commandant of the Philadelphia yard not later than Jan. 5, 1912.

The Cost of the Special Order

We heartily commend the article on this subject, which appears in another column, to the careful consideration of machine manufacturers. Special machines must be built in many instances, but there are plenty of firms who make a business of this kind of work, and who know how to handle it both mechanically and financially. The average shop rarely charges enough to cover all the costs which have been incurred.

Special machines are all too often the result of an overworked inventive genius, and do not accomplish enough more to warrant their being built. The desire to put and leave monuments of our individual genius prevails just as much in the machine shop as it does in the building of libraries. Too many changes are made with the idea that they are necessary to show ability, without regard to the real cost or the actual results obtained.

We object strenuously to all plans for casting all men in the same mold, but the standardization of machines is a very different proposition and is being recognized as one of the very desirable developments of machine building.

The sooner machine builders refuse to build special machines the better. Or if it seems absolutely necessary, make the price large enough to cover delays to other work, disorganization of the shop routine and all other costs which enter into it.

New Publication

THE SCIENTIFIC DIGEST. Volume 1, No. 1. Twenty-seven 9x12-inch pages. Published monthly. The Scientific Digest, Kansas City, Mo. Price $1 per year.

The purpose of this digest is to review articles of general interest that have been published in domestic and foreign scientific and semi-scientific journals. The announcement states that "care will be taken to avoid topics not of general interest to the lay public and to present only such articles as are written in a style that can be understood by the average person interested in scientific subjects." This first number contains 42 such reviews, covering a wide range of subjects. These range from a German seige gun to a motor sled, and from a steel scrubbing machine to color photography.

Personals

H. A. Severson, manager of the Barber-Colman Co., Rockford, Ill., is at present in Europe on a business trip.

Robert S. Alter, secretary American Tool Works Co., returns on Dec. 22 from an extended business trip in Europe.

Leo C. Steinle sailed on Thursday, Dec. 14, for Europe to act as special representative of Niles-Bement-Pond Company.

Charles F. Barth, manager of the West Allis works of the Allis-Chalmers Co., resigned on Dec. 1. Mr. Barth has been in poor health for many months past.

Leo G. Smith has resigned his position as general superintendent of the steel foundry department of the Londonderry Iron and Mining Co., Londonderry, Nova Scotia.

Alvar K. Ternstedt, formerly with Frank Mossberg Co., Attleboro, Mass., has been appointed general manager of the Perfect Window Regulator Co., New York City.

Anton Getz has become general superintendent of the Pittsburg Emery Wheel Co.'s plant, at Rochester, Penn. Mr. Getz was formerly in the engineering department of the Indiana Steel Company.

Howard B. Clark, until recently chief engineer with William H. Flaherty, Trenton, N. J., has accepted a position with the McNaull Boiler Manufacturing Company, Toledo, Ohio, and will act as eastern representative.

Holden A. Evans, Naval Constructor, United States Navy, has resigned from the service, his resignation to take effect Jan. 1, 1912. He is to become vice-president of the Moran Shipbuilding Co., Seattle, Washington.

Fred B. Corey, who has been engineer of railway signals with the General Electric Company, has accepted a position with the Union Switch and Signal Company, Swissvale, Penn., where he will be in charge of the inspection and testing department.

Ira Gould Hoagland has been appointed editor and manager of *Insurance Engineering*, a monthly magazine devoted to the science of diminishing dangers to property and life. Mr. Hoagland has been actively connected with the fire prevention movement.

Percy R. Richardson, member of the firm of D. Richardson & Sons, Footscray, Victoria, Australia, is planning to visit England and America early in the new year, and solicits correspondence with those firms desiring Australian representation or other commercial service.

Frederick J. V. Skiff, director of the Field Columbian Museum at Chicago for the past fourteen years, has accepted the appointment of director-in-chief of foreign and domestic participation of the Panama-Pacific International Exposition which is to be held in San Francisco in 1915.

C. A. Hamilton, who for the past six years has been vice-president and general manager of the Wisconsin Engine Co., Corliss, Wis., has resigned his position to take an interest in the Lavigne Gear Co., Milwaukee, Wis. Mr. Hamilton has been elected vice-president and general manager of this company.

S. B. Redfield, formerly associate editor on the staff of the AMERICAN MACHINIST, has accepted a position with the Ingersoll-Rand Co., and will act in the capacity of engineer of tests at their Phillipsburg plant. Mr. Redfield was connected with the engineering department of the Ingersoll-Rand Co. prior to his editorial experience.

The Franklin Institute Alumni Association, organized by graduates of the school of mechanic arts of the Franklin Institute, is desirous of obtaining the addresses of all graduates and former students in this country and elsewhere. Former graduates or those who may have any information relating to them are requested to communicate with the secretary of the association, Charles E. Hubsch, who can be addressed care of the Franklin Institute, Philadelphia, Penn.

Shop Equipment News

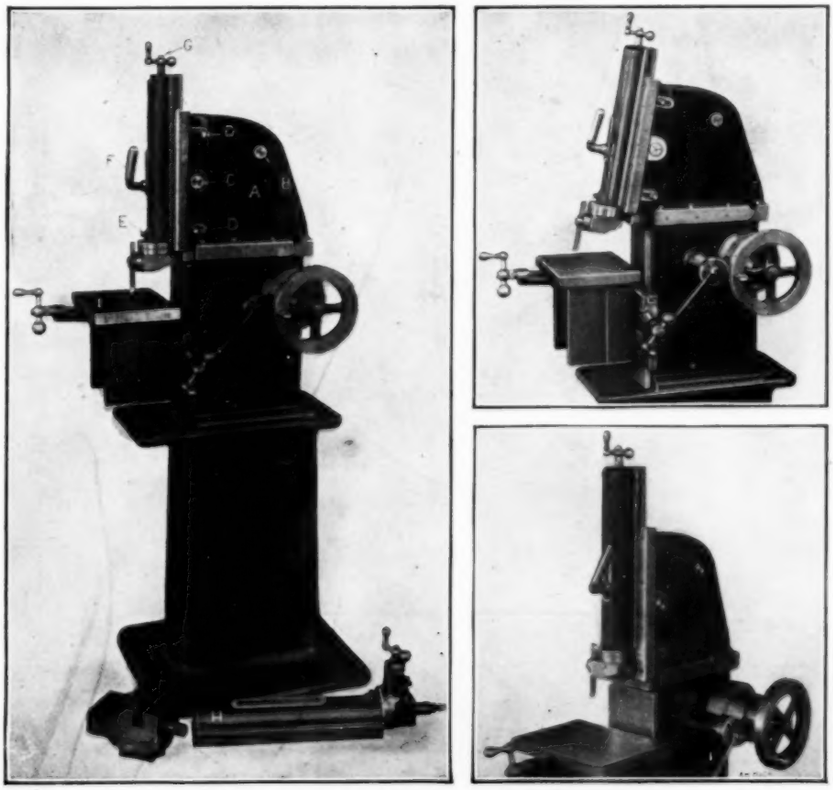
New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

A Horizontal Shaper with Vertical Attachment

The halftones show a vertical shaping attachment which has just been put on the market by L. E. Rhodes, Hartford, Conn.

This attachment is intended for use on the 7-inch precision shaper manufactured by the same concern. To convert the horizontal shaper into a vertical shaper, the ram *H*, Fig. 1, is removed and the attachment secured in its place by the cap screws shown. The attachment consists of a housing *A*. Pivoted on *B* is a bell crank, one end of which connects with the rocker arm of the shaper and obtains its motion therefrom. The other end of the bell crank is in the form of a segment on which teeth are cut. These teeth mesh with a spur gear mounted on the shaft *C* and these in turn mesh with a rack on the vertical ram. The stroke of the ram is altered in the usual way and the position of the stroke by the ball handle *G* and binder *F*.

As the ways for the vertical ram pivot also on the shaft *C*, the ram and ways can be tilted at an angle with the table for work which is to be machined at an angle. The cap screws *D* clamp the ram ways at any desired angle. A positive stop is provided for setting the ram ways vertical.



A Shaper with Vertical Attachment

The ram head can be swiveled as shown in the various views and clamped by the setscrew *E*. A clapper box is provided so that the tool releases on the return stroke.

An auxiliary table *I* is for use with this attachment. This gives a feed by hand at right angles to the power traverse of the table.

The change from horizontal to vertical can be made in about ten minutes.

The stroke of the vertical ram is variable, from 0 to 3½ inches, or half that of the horizontal ram.

The maximum distance under the ram is 8½ inches.

The lateral feed is 9 inches.

Condensite

A material under the above name has recently been placed on the market by the Condensite Co. of America, Glen Ridge, N. J.

The material is prepared in many forms. In solution it can be used for technical purposes, as an air-drying varnish, as an oven-drying enamel or as a cement; it can be made transparent or translucent, and in a variety of colors. It can be adapted to be used for impregnating electrical apparatus, or impregnating wood and other fibrous or cellular substances and can be used for molding. It is supplied either as a fine powder to be used in closed molds or as a cold plastic which may be readily formed to any desired shape preparatory to molding, and which can be used in either open or closed molds.

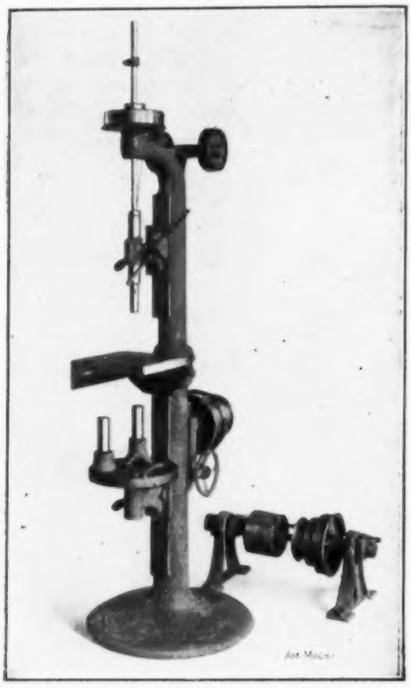
In its simplest form this substance is gum-like, transparent, hard and fusible at moderate temperatures, does not harden under action of heat and is soluble in alcohol and similar solvents. When subjected to further chemical treatment, and upon being heated, the substance possesses other properties. It becomes hard and strong, will not fuse or soften under the action of heat, is not soluble in alcohol and similar solvents, and is high in dielectric strength.

15 Inch Driller

The accompanying halftone shows a 15-in. driller equipped with ball bearings and designed to carry high-speed drills up to ¾ in. in diameter. The drive from the back cone to the spindle pulley is by quarter-turn belt running over idler pulleys. The construction of the spindle pulley is such that the belt tension is carried on an independent bearing, thereby relieving the spindle so that it runs freely. This bearing is surrounded by a concentric ring which retains the oil and prevents spatter.

The belt tension is controlled by an automatically locked belt tightener. The

arrangement of this locking device is such that the cone is locked in every position in which it may be left and the only labor necessary to change the belt tension is to turn the handwheel.

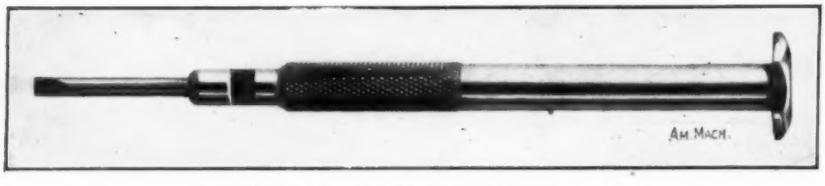


FIFTEEN-INCH DRILLER

The machine is fitted with both a square and round table, the square table, which may be tilted, being on a bracket which revolves around the post. The square table is 12x12 in. and its apron 12x4 in. The round table is 12 in. in diameter and slides on the column and may be removed. The net weight of the machine with countershaft is 625 lb. It is a recent design of the Washburn shops of the Worcester Polytechnic Institute, Worcester, Mass.

Revolving Head Screwdriver

The screwdriver shown herewith has a revolving head which in use rests in the hollow of the hand while the driver is twirled between the index finger and the thumb. In assembling and disassembling light work the driver is especially handy and rapid. The tool is highly polished and nickel plated, and the blade is reversible, made of drill-rod steel. The hexagon form of head prevents rolling when the tool is laid down.

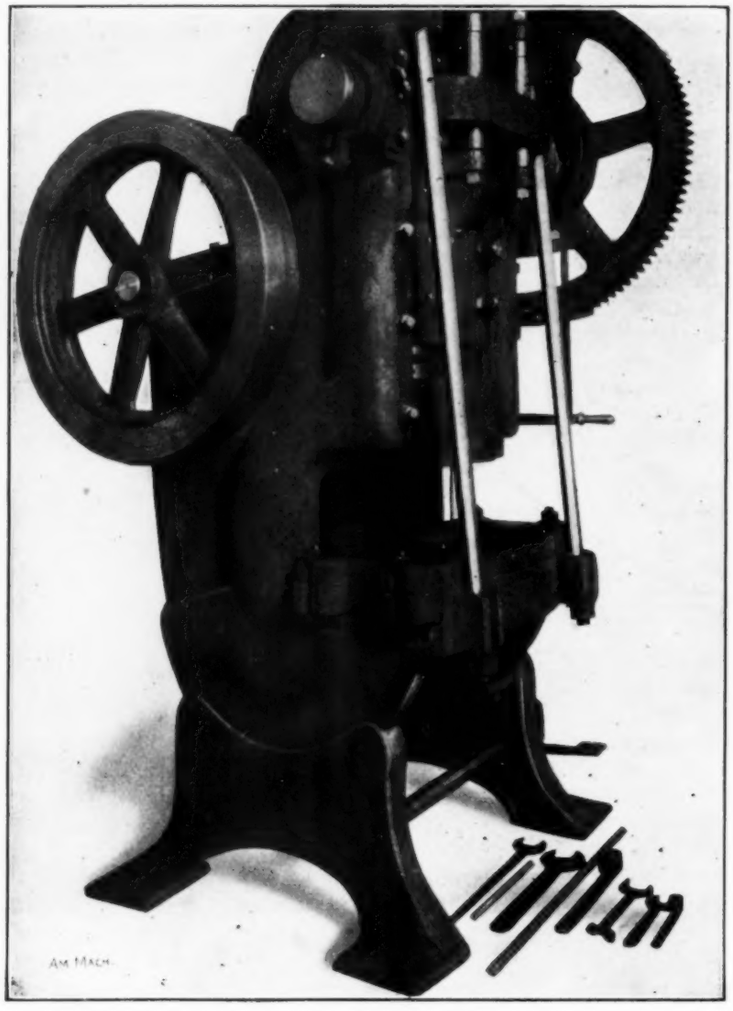


A REVOLVING HEAD SCREWDRIVER

This type of driver is a recent product of W. A. Peck, 141 Brewery St., New Haven, Conn.

Double Acting Cam Press

The double-acting cam press shown herewith was designed for deep drawing, at a single stroke, of light- and medium-gage metals. It was especially designed for the drawing and forming of stock with maximum flow and maximum ductility without broaching or breaking, such as mild aluminum, brass and copper.



DOUBLE-ACTING CAM PRESS

The machine is equipped with an extra-heavy, drop-forged crankshaft with tool-steel cams forced over the wings of the shaft, which are on either side of the upper connection of the inner or drawing ram. The length of the cams overall is $4\frac{3}{8}$ in., and they have actual bearing surface of 3 in. The press is equipped with boxes 9 in. in length; maximum radius of the cam is $7\frac{1}{16}$ in. and the minimum $4\frac{1}{16}$ in., allowing a throw on the blanking ram of 3 in. The object of this large throw is to allow the production at a single stroke of a piece over 3 in. high without a raising die. The drawing stroke or the stroke of the inner plunger is 7 in., and the machine is so arranged that the blanking and drawing ram leave on the up-stroke at the same time. This is controlled by the setting of the cams on the crankshaft.

The machine is fitted with capped boxes, allowing the shaft to be taken out without putting it through endwise. The yokes are of steel, the two lower ones extending through bronze-bushed holes in the blanking ram and controlling the adjustment of the blanking ram by the adjusting spanner nuts, shown in the lower part. The four screws on the blanking ram are set in elliptical holes

with bushings bearing against the shanks of the lower yokes; the upper yokes are of forged steel and are connected by steel pins relieved on the inside for cam clearance. The supporting straps on the back and front of the press are babbitted. The inner plunger is of forged steel and runs up and down in the blanking plunger through a bronze sleeve. The gearing is single-trained and cut, and the machine is fitted with instantaneous, roller-friction clutch. The machine is a recent product of the Standard Machinery Co., Providence, R. I., and is furnished either with balance wheel or tight-and-loose-pulley drive.

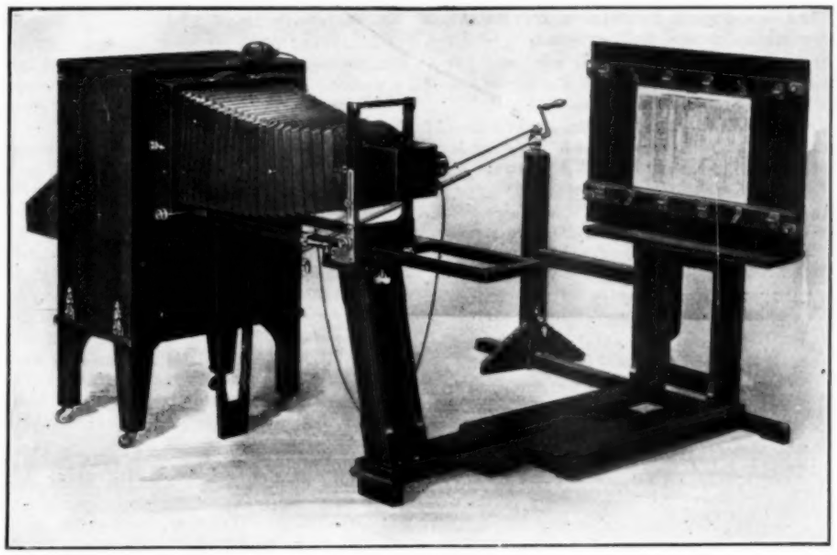
The Rectigraph

The halftone shows an automatic photographing machine built by the Rectigraph Co., Rochester, New York. This machine copies or reproduces drawings, blueprints, written, printed or typewritten matter, etc.

The complete process of photography is embodied in the machine itself but unlike the ordinary photographic process no plates or films are necessary. The copy is made direct from the subject onto the paper with this difference; what is light in the subject is dark in the rectigraph reproduction, for instance, a black-line drawing on white paper would be reproduced as a white-line drawing on a dark background. Where it is desired to have the reproduction the same as the original a second reproduction is made, using the first copy as a subject and the colors are again reversed, making the second reproduction the same as the original copy.

With this machine no dark room is necessary. The copy is placed in the copy holder and the image is brought to correct focus on the ground glass, exactly the same as in the ordinary camera. The ground glass is then lifted out and the magazine, which forms the rear of the machine, is connected to the back of the camera member.

This magazine contains a 500-ft. roll of sensitized paper which is put up in much the same manner as the roll films used in small hand cameras and like them can be loaded in the machine in daylight. The turning of a crank brings the paper into position for exposure which is done in the usual way by means of a shutter operated by a bulb. After exposure the crank is again turned and the exposed part of the paper is cut off and automatically carried to the developing tank in the bottom of the machine where it remains the necessary period of time. While this first print is being developed another exposure is being made either of the same or another subject. When this is complete the turning of the crank carries the first print into the fixing bath at the back of the machine, while at the same time the second print is carried to the developing tank. After each cycle the crank is automatically locked to prevent accidental operation.



THE RECTIGRAPH

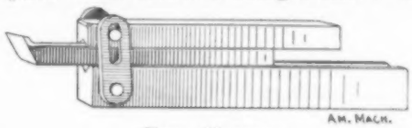
The speed of the machine depends upon the speed of the operator and the light. The average operator should be able to produce from one to three prints per minute and a book of 480 pages has been copied in 62½ min. The machine will make reproductions from 7½x13 in. to 11x13 in. rising by half inches.

After the prints come from the fixing bath they are washed and dried in the usual way, when they are clear, legible, and permanent.

Tool Holder

The holder shown in the accompanying line cut was designed to accommodate round, flat, square, hexagon and other shaped tools in a wide range of sizes.

The holder is made of hardened steel, accurately machined. The two machined parts are held together by a slotted link, which holds them parallel, so far as side motion is concerned, but allows the two parts of the holder to swing around in a straight line and reverse their position, the top becoming the bottom and *vice versa*. The heavy portion of the holder has a deep V-slot on one side and a hair-line slot on the opposite, while the lighter bar has a V-slot in one side and is plain on the other. The V-slot in the lighter portion registers with the deep V-slot in the heavy bar, enabling large tools to be held; when reversed the small or hair-line slot has a plain bar opposite it, enabling the holder to clamp the lightest of tools.



TOOL HOLDER

This form of holder is a recent product of B. Morgan, Newport, R. I.

Decision in Molding Machine Patent Suit

At the October term of the United States circuit court of appeals for the third circuit, decisions were handed down in two cases involving alleged infringement of certain molding-machine patents. Three patents were involved, Nos. 533,401, 582,325 and 654,292. The plaintiff in the original suit was the Tabor Manufacturing Co., of Philadelphia, Penn., and the defendant the Mumford Molding Machine Co., of New York. The opinion of the circuit court that none of the three patents in litigation were infringed was upheld by the court of appeals.

The claim in the first patent which was alleged to be infringed covered a combination in which one of the elements is a "pattern plate which moves laterally when actuated by the power device."

Four claims of the second patent covered combinations in each of which there was a "pattern plate having mortises or apertures between the patterns and away from the margins of the patterns." Another claim has as an element in its combination "guard strips at the sides of fingers which support the flask-supporting frame whose function is to prevent the entry of sand between the frame and the upper ends of the fingers." In the last patent three claims were in controversy, in each of which there was specified "means for maintaining a carrier and the patterns in parallelism with themselves." In regard to all these claims the circuit court of appeals upheld the defense of the Mumford company, deciding that none of the patents sued on are infringed.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

The Wire Goods Co., Worcester, Mass., has purchased site for a new plant.

Bergin Brothers will build a commercial garage on East Main St., Waterbury, Conn.

Pittsfield Auto Garage Co., Pittsfield, Mass., has been organized with $3000 capital by M. I. Mills, A. A. Mills, etc.

The Bay State Stamping Co., Worcester, Mass., is to erect an addition to its present plant for manufacturing purposes.

The Majestic Manufacturing Co., Worcester, Mass., manufacturing bicycles and motor-cycle supplies, is to start in the manufacture of side cars for motor cycles.

The Producer Gas Power Co. has been organized at Augusta, Me., for the manufacture and sale of Akerland soft-coal gas producer. E. M. Leavitt, president and treasurer.

The Norwich Automatic Feeder Co., Norwich, Conn., has incorporated with $30,000 capital to manufacture automatic feeding and watering appliances. Incorporators are Francis De L. Sullivan, New York, and Henry H. Walker and Frank Enos, Jr., of Norwich.

MIDDLE STATES

The Toledo (Ohio) Auto Delivery Co. will build and equip a garage.

Fred Simonson, of Graettinger, Iowa, is building a new blacksmith shop.

The Brooks-Norton Motor Sales Co., Cleveland, Ohio, will equip a garage.

The Galion (Ohio) Iron Works will erect a two-story addition to its plant.

The Atchison, Topeka & Santa Fé R.R. will build machine shops at Peoria, Ill.

It is reported the Baltimore & Ohio R.R. is to erect a roundhouse in Garrett, Ind.

The Ravena Iron Co., Ravena, N. Y., is considering the installation of new machinery.

The Cleveland (Ohio) City Lumber Co. will make additions to its planing-mill equipment.

The Harris Ring Fence Co., Cleveland, Ohio, will want some new wire-fence machinery.

The Columbia Vehicle Co., Hamilton, Ohio, just incorporated, will buy some machine tools.

Dodge Brothers, 240 Monroe Ave., Detroit, Mich., will build a blacksmith shop to cost $30,000.

The Excelsior Stove Works, Philadelphia, Penn., will build a plant at Eureka and Sepviva Sts.

The Kerite Insulated Wire & Cable Co., Seymour, Conn., will build an addition to its plant.

The Pope Tin Plate Co., Steubenville, Ohio, it is reported, will build a branch plant in St. Louis.

The Attwood Wrench, Tool & Stamping Co., Conneaut, Ohio, is in the market for machine-shop tools.

The Presto Vending Machine Co., of St. Louis, will move its manufacturing plant to Evansville, Ind.

The Erie (Penn.) Forge Co. will enlarge its plant. New machine and pattern shops will be erected.

The Newburgh (N. Y.) Ice Machine & Engine Co. has let the contract for the erection of a new tool shop.

The Cleveland (Ohio) Taxicab Co. will need some more machinery for its large complete garage just erected.

E. Humpherville has let contract for a two-story garage at Old York road and Wagner St., Philadelphia, Penn.

The Camden Water Wheel Works, of Camden, N. Y., is planning a modern plant to be erected in the spring.

A two-story garage will be erected at the corner of Broad and Commerce Sts., New Haven, Conn., for H. L. Starin.

The Smith Motor Co., manufacturer of automobile motors, at Terre Haute, Ind., will double the capacity of its plant.

James H. Matthews & Co., Pittsburg, Penn., manufacturing stamps, stencils, etc., will erect a new $140,000 plant.

The Wagner Stone Co., Sandusky, Ohio, has raised its capital to $500,000 and will need new quarry and other stone-working tools.

The Strong Manufacturing Co., Bellaire, Ohio, manufacturing enameled ware, is negotiating for a site at Sebring, Ohio.

The Locomotive Superheater Co., 30 Church St., New ork City, is contemplating the erection of a plant in the Chicago district.

James Rowe, printing press and repairs, will build a two-story factory at 1058-62 West Harrison St., Chicago, and will add new tools.

The Knowlton Manufacturing Co., of Canton, S. D., has been organized and will build a gasoline-engine manufacturing plant at once.

The Buffalo Bolt Co., North Tonawanda, N. Y., has commenced the construction of new additions, which are estimated to cost $45,000.

Robert M. Green, manufacturing soda apparatus, has purchased a five-story factory building at Seventeenth and Pearl Sts., Philadelphia, Penn.

The New York Central & Hudson River R.R. contemplates building two plants, one at Ashtabula ,and one at Toledo, Ohio, for repairing steel freight cars.

The Union Electric Welding Co., Toledo, Ohio, just incorporated, will equip a factory to make a line of electric welded products. J. J. Urschel is manager.

Federal Truck Co., Chicago, Ill., has been incorporated to build automobiles, trucks, etc., by Carren W. Rhodes, David F. and Leo S. Rosenthal. Capital, $10,000.

The Czar Ignition Co., 732 Main St., Buffalo, N. Y., has been incorporated with a capital of $12,000 to manufacture spark plugs and other ignition apparatus.

Uneeda Vacuum Cleaner Co., Chicago, Ill., has been organized to build vacuum cleaners and other devices, by O. R. Barnett, P. H. Truman, H. L. Peck. Capital, $25,000.

The De Tamble Motors Co., automobile manufacturer, at Anderson, Ind., is building an addition to its plant and will install a large amount of new machinery.

The C. E. Whitehead Time Recorder & Supply Co., Chicago, has been incorporated to manufacture time-recording machines by Chas. W. Whitehead, Jas. B. Smith, etc.

It is reported that the plant of the Tonawanda Iron & Steel Co., North Tonawanda, N. Y., will probably be remodeled into a rolling mill during the coming spring.

The White Motor Car Co., of Cleveland, is asking for bids for the erection of a two-story garage, repair shop and sales building, at Craig and Atherton Sts., Pittsburg, Penn.

The Indiana Brass Co., Frankfort, Ind., has been incorporated with $10,000 capital to manufacture brass wares. Directors, J. A. Johnson, C. E. Williams and C. J. Johnson.

The Ormond Motor Car Co., Brooklyn, N. Y., has been incorporated to manufacture motor vehicles, etc. Capital, $100,000. Incorporators, G. H. Howell, R. McKeller, J. Downs.

The Duplex Motor Plow Co., Chicago, Ill., has been organized with $5000 capital to manufacture farming machinery. Incorporators, Howard W. Lewis, H. V. Shepard, J. H. Lewis.

The Muncie (Ind.) Ornamental Iron Works has been incorporated to manufacture structural iron, steel, etc. Capital, $10,000. Incorporators, C. W. Hanika, John Fitzgibbons.

The F. A. L. Auto Co., Chicago, Ill., has been organized with $25.000 capital to manufacture and deal in motor vehicles, etc. Incorporators, F. C. Harboer, C. S. Lamb, E. E. Lundberg.

The F. B. Stearns Co., of New York, has completed its new auto-service building at 415-17 West Fifty-fifth St., Cleveland, Ohio. It will equip a machine shop and a forging shop.

The North Buffalo Hardware Foundry, 28 Erie St., Buffalo, N. Y., new concern, will erect a plant at Hertel Ave. and the Erie R.R. for the manufacture of small gray-iron castings.

United Car Co., Chicago, Ill., has been incorporated with $30,000 capital to build, repair and deal in cars, engines and railroad equipment. Incorporators, John R. Owen, S. C. Abbott, A. O. Berg.

The Penn Motor Car Co., Camden, N. J., has been incorporated to manufacture automobiles, motor vehicles, etc. Capital, $500,000. Incorporators, V. A. Murray, L. A. Myers, Doering Bellinger.

The Bourne Fuller Co., Cleveland, O., maker of heating ranges and cooking appliances has raised its capital to $2,000,000. Will build additions to its plant and will need new machinery.

The Cleveland Copemoor Electric Stove Co., Cleveland, Ohio, has been incorporated to manufacture electric stoves, etc. Capital, $10,000. Incorporators, J. B. Roof, Kent B. North, J. C. Rahming, etc.

The Long Island Iron & Steel Co., Brooklyn, N. Y., has been organized to manufacture and deal in iron and steel. Capital, $50,000. Incorporators, J. E. Whitney, New York; B. D. Leich, Brooklyn, etc.

The Augustine Rotary Motor Co., Buffalo, N. Y., has just completed a three-story factory and has decided to further enlarge its plant by a two-story addition, which will be constructed during the coming year.

Manufacturing plant and power plant will be built in the vicinity of Knoxville, Tenn., by the Aluminum Company of Ameria for the manufacture of aluminum from bauxite deposits. General offices, Pittsburg, Penn.

The Union Sales Co. has leased a plant in Columbus, Ohio, for the manufacture of automobiles. This concern was recently organized by J. W. O'Brien, Harold Bach, et al., for the manufacture of its new car, the "Union-25."

The P. J. Smith Machine Co., Monroe, Mich., manufacturing glue presses and veneering machinery, will move to Bay City, Mich., and merge its plant with that of the McKinnon Boiler & Machinery Co. Several new buildings will be erected.

The Fidelity Machine Manufacturing Co., Philadelphia, Penn., has been incorporated to manufacture textile and special machinery. Capital, $25,000. Plant has been acquired in Frankford. J. J. Higginbottom, 2021 East Huntington St., is interested.

The Springfield Compressed Air Co., Springfield, Ohio, has been incorporated with $100,000 capital to manufacture the newly patented Keyser air compressor. Incorporators, L. C. Keyser, J. H. Jenkins, J. D. Gierhart, O. M. Martins and J. P. Goodwin.

SOUTHERN STATES

The American Sheet & Tin Plate Co. will enlarge its plant at Chester, W. Va.

The John Boyle Co., Baltimore, Md., will erect a can factory, at Wolfe and Thames Sts.

The Florida Metal Products Co., Jacksonville, Fla., has been organized with a capital of $150,000 to construct a plant for the manufacture of metal shingles, corrugated roofing and Spanish tile.

WEST OF THE MISSISSIPPI

The American Can Co., Portland, Ore., will build an addition to its plant on Front St.

P. C. Cresco, Tacoma, Wash., plans for the erection of a commercial garage and repair plant.

F. L. Kieatt, San Diego, Cal., has taken out a permit to build a machine shop on California St.

The City Ornamental Iron Works, San Diego, Calif., has taken out a permit to build an addition to its plant at Ninth and J Sts.

C. C. Colyear, Los Angeles, Calif., has leased property on West Pico St., and will establish a modern commercial garage and repair plant.

Quirk Brothers, San Diego, Cal., will build a commercial garage and repair plant on Third St., near B St. Modern machinery will be installed.

The Thomas McKay Co., Seattle, Wash., is having plans prepared for a commercial garage and machine shop to cost $25,000. Modern equipment will be installed.

Berg & Wilson, Ontario, Calif., contemplate improvements and additions to their commercial garage and repair shop on North Euclid Ave. The capacity will be increased.

The C. L. Boss Co., Portland, Ore., agent for the Reo and Apperson automobiles, will establish a modern commercial garage and repair plant, at Washington and Twentieth Sts.

George Armitage, Altadena, Calif., plans for the erection of a commercial garage and repair plant at East Ninth St. and Santa Fé Ave., Los Angeles, Calif. Modern equipment will be installed.

The Salem, Falls City & Western Ry. Co. will make extensive improvements in its shops, at Dallas, Ore. An addition will be erected to the roundhouse and the capacity of the plant will be increased.

The National Cartridge Co., Napa, Calif., operating a cartridge-manufacturing plant, has been acquired by new interests. The capacity of the plant will be increased by the erection of an addition, and new equipment installed.

Morrow, Loomis & Co., Los Angeles, Calif., automobile dealers, have leased property on Central Ave., and will establish a plant for the manufacture of the "Moro" automobile. The plant will be fully equipped with modern machinery.

The American Silent Motors Co., Los Angeles, Calif., recently incorporated with a capital stock of $2,000,000, plans for the erection of a $125,000 plant, near Los Angeles, for the manufacture of automobiles. Benjamin Waterfall and R. J. Connors are at the head of the company.

The Reliable Starter Manufacturing Co., Waterloo, Iowa, has filed articles of incorporation at Phœnix, Ariz., with a capital of $400,000. D. H. Lansing, W. D. Markham and E. B. Rees are incorporators. The company will establish a plant for the manufacture of internal-combustion engine starters.

CANADA

The Brantford Oven & Rack Co. will build a new factory at Brantford, Ont.

The Lightning Furnace Co. will equip a large new foundry and plant at St. Johns, Quebec.

P. McCullough will build a new factory at Sherbrooke, Que., for manufacturing brake shoes for cars.

John Robinson & Son, of Niagara Falls, Ont., are calling for tenders for garage equipment, belt-driven air compressor, etc.

G. M. Gibbs, Granville St., Vancouver, B. C., is manager of a company which will equip a big new steel mill on the Fraser River, near there.

General Manufacturing

NEW ENGLAND

The plant of the Dux Toy Co., Concord, N. H., was burned. Loss, $15,000.

The Sanitary Cement Co., Everett, Mass., has plans to extend its plant.

The Lewiston (Me.) city council is to establish a municipal ice plant in that city.

Fire destroyed the power plant at the Brown Rubber Co.'s plant, in Providence, R. I.

The United States Worsted Co., Harrisville, R. I., will remove to Lawrence, Mass.

The shop of C. H. Osgood & Son, South Freeport, Me., boat builders, was destroyed by fire.

The Carlisle Laundry, Attlebore, Mass., was destroyed by fire. Loss, $8000. Will probably rebuild.

The Sanitary Cement Co., Everett, Mass., has purchased land on which to extend its plant.

The plant of the Converse Rubber Shoe Co., Malden, Mass., was badly damaged by fire and water.

The factory of the Jos. Ouimett Optical Co., Southbridge, Mass., was destroyed by fire. Loss, $13,000.

The Wadsworth & Howland Paint Co., Malden, Mass., will erect a three-story addition to its factory on Green St.

The Standard Raincoat Co., of Boston, Mass., has purchased a plant at Milford, Mass., and will manufacture raincoats.

Fire completely destroyed the plant of the Crescent Bottling Co., Alstead, N. H., causing a loss of several thousand dollars.

The American Felt Co., Franklin, Mass., plans to increase the capacity of its plant by the erection of new buildings.

Whitney & Co., Leominster, Mass., have purchased a factory in that town and after extensive improvements will manufacture paper.

J. F. Gallagher & Co., Toronto, Can., manufacturers of celluloid, contemplate locating a plant, costing $200,000, at Worcester, Mass.

George H. Clemence, Southbridge, Mass., will install a small boiler and a gasoline engine for power in new buildings to be erected.

The Nadeau Extender & Cement Co. has been organized at Portland, Me., to manufacture lime and cement. T. Nadeau, president; Sidney Thaxter, treasurer.

The Bartels & Thelen Co., of Chelsea, Mass., has leased the shoe shop of the National Shoemakers, Lewiston, Me., and will equip same for the manufacture of shoes.

Black & Gay, canners, have been organized at Rockland, Me., for the purpose of carrying on a general canning business. Fred C. Black, president; Geo. A. Gay, treasurer.

The Zenicon Thread Co. has been incorporated at Boston, Mass., with a capital of $15,000. The incorporators are: Harry P. Small, Robert C. Jamieson and Howard M. Dodge.

The Rochdale (Mass.) Woolen Mills, recently purchased at auction, by a corporation, is to be extensively altered and new machinery will be installed. F. A. Jealous is agent.

The Jersey Ice Cream Co., Lawrence, Mass., will build an ice-cream factory on State Road, near Water St. Plans have been prepared by Ashton & Huntress, 477 Essex St., Lawrence.

The Frost Finishing Co., Barrington, R. I., is to double the present capacity of its factory by consolidation with the O'Bannon Corporation, which controls factories at West Nutley, N. J. Material for bookbinding is manufactured.

Whitney & Co., Leominster, Mass., manufacturer of boxes, have purchased the factory on Mill St., North Leominster, formerly occupied by the National Fireboard Co., and contemplate equipping same for the manufacture of paper.

The Pike Shoe Co., Marlboro, Mass., has incorporated with $50,000 capital to manufacture shoes. President, Wm. H. Herrick, Natick, Mass.; treasurer and manager, Everett S. Pike, Brookfield, Mass. The O'Connell factory, on South St., has been secured and will be equipped immediately.

The Prospect Finishing Co., a new corporation, capitalized at $100,000, is to locate a plant at Pawtucket, R. I., for manufacturing, dyeing, bleaching, etc., of cotton, woolen and other fabrics. Incorporators, F. G. Rowley, H. C. Barnfield, of Pawtucket, and J. Quarmby, of Lincoln, R. I.

The S. L. Uhrig Co., Pittsfield, Mass., has incorporated with $25,000 capital to manufacture cigars and cigarettes. A large factory will be built as soon as a location is decided upon. President, W. E. Putnam; vice-president and general manager, S. L. Uhrig, Pittsfield; treasurer, F. H. Francis.

MIDDLE STATES

G. A. Manley, of Bloomer, Wis., will build a sawmill at once.

Fred Miller, Salamanca, N. Y., is building a sash and door factory.

The W. H. Baker Chocolate Co., of Red Hook, N. Y., is enlarging its plant.

The Standard Pulley Co. will enlarge its plant at Cumminsville, Cincinnati, O.

Cramp & Co. have plans for a power plant at Front and Allegheny Ave., Philadelphia.

The Barnet Leather Co., of Little Falls, N. Y., will erect a six-story addition to its plant.

The Farrora Furniture Co., of Oneida, N. Y., is considering the enlargement of its plant.

The Victor Rubber Tire Wheel Co. has acquired site for a new plant in Springfield, Ohio.

The Baltimore & Ohio R.R. will build a new power plant at its Zanesville, Ohio, shops.

Fire damaged the rim factory of the McNaull Auto Tire Co., on Cherry St., Toledo, Ohio.

A new plant is being built in Pittsburg, Penn., by the Zemmer Co., manufacturing chemists.

The Niagara Chocolate Co., recently organized, will erect a factory at Niagara Falls, N. Y.

A permit has been issued to the Diebolt Brewing Co., Cleveland, Ohio, to build an addition.

The pattern shop of Bement Miles Co., at Ruffner and Alfred Sts., Philadelphia, was destroyed by fire.

The Fancher Furniture Co., Salamanca, N. Y., newly organized, is building a plant to employ 100 hands.

Fire destroyed the grist mill and excelsior manufactory of John M. Cantwell, at Malone, N. Y. Loss, about $8000.

The Lebro Knitting Mill, 638-40 North Eighth St., Philadelphia, Penn., was destroyed by fire. Loss, $35,000.

An addition will be built to the boiler house of J. C. Frasch, corner Erie and Salmon Sts., Philadelphia, Penn.

The plant of the Lewis Electric Welding & Manufacturing Co., Toledo, Ohio, was badly damaged in a recent fire.

The Libby, McNeil & Libby Co., at Buffalo, N. Y., will need power-plant equipment for large warehouse to be erected.

The Rice Bottling Works Co., Cleveland, Ohio, is building a new plant and will want some new bottling machinery.

The International Auto League & Tire Co. will erect a factory at Buffalo, N. Y., for the manufacture of automobile tires.

Plans have been filed for a seven-story warehouse at Horatio and West Sts., New York, for the estate of Eugene A. Hoffman.

The DeWitt Wire Cloth Co., Belleville, N. J., will increase the capacity of its power plant. Will install new engine and boilers.

The Hardman Rubber & Tire Co., Belleville, N. J., will increase the capacity of its power plant. Will install a new engine.

Plans have been filed for the erection of a new plant at Fifty-third St. and Whitney Ave., Philadelphia, Penn., for the American Ice Co.

The Kehoe-Meisbart Co. will build a one-story wagon factory at 118-20 South Center Ave., Chicago, and will equip with new tools.

The Kunz & Adams Co. has secured a location at Black Rock, Buffalo, N. Y., where it will erect a plant for manufacturing broom handles.

Power plant, electric-lighting plant, etc., will be needed for the large grocery warehouse to be built by the Wiedeman Co., of Cleveland, Ohio.

The Willowville Bleaching Co., of Utica, N. Y., has secured a building for the operation of a branch plant, to make sheets and pillow cases.

Ferguson Brothers Manufacturing Co., Hoboken, N. J., will increase the capacity of its power plant. It will install two new boilers, generators, etc.

Mildner & Eisen, Hammond Building, Detroit, are preparing plans for a two-story brew house for the Tivoli Brewery Co., Estimated cost, $25,000.

A building permit has been issued to the Fisk Rubber Co. for the erection of a two-story brick building, at 5933 Baum St., Philadelphia, Penn., to cost $12,000.

The Mehlin Piano Co., has purchased two city blocks near Twentieth St., Weehawken, N. J., on which it will erect a factory to replace its present New York City plant.

The Leader Publishing Co., Cleveland, Ohio, will erect and fully equip a large modern newspaper plant. Machinery, power, heating and other equipment will be purchased.

Frank B. Graves, shoddy manufacturer, of Albany, N. Y., has purchased the Commercial Mills, at Cohoes, N. Y., and will use the plant for the manufacture of wool shoddies.

The Western Union will erect a 26-story building, at Broadway and Dey St., New York, to cost about $3,000,000. Power plant will be installed. Wm. W. Bosworth is the architect.

An addition will be built to the factory of W. H. Wiley & Son, Pliny St., Hartford, Conn.; also addition to the boiler house. The concern manufactures overgaiters, leggings, etc.

The Puritan Chemical and Manufacturing Co., Cleveland, Ohio, has been organized to manufacture soap, etc. Capital, $10,000. Incorporators, W. L. Brown, M. H. Brown, L. E. Yaggi, etc.

The old plant of the Malcolm Mills, at Catskill, N. Y., which has been closed down for about three years, has been purchased by the Union Mills, and operations will be resumed about January 1.

The Batavia (N. Y.) Rubber Co. will increase its capital stock from $70,000 to $500,000, and plans for greatly enlarging its plant to manufacture solid rubber tires and automobile tires are being considered.

J. B. Powell, head of a syndicate of capitalists, will develop oxide iron-ore deposits in Lawrence County, Tenn. Machinery for drying, crushing and pulverizing the ore for the manufacture of red mineral paint is wanted. Addrss Dr. James B. Powell, Box 23, Nashville, Tenn.

Allen Hazen, of 103 Park Ave., New York City, has submitted to water superintendent, Edward L. Peene, the plans and specifications for a 10,000,000-gallon pipe, which the city of Yonkers, N. Y. proposes to install at its filter beds. It is expected that the board of contract and supply will advertise in January for bids to furnish the pump.

SOUTHERN STATES

The National Paper Co., Atlanta, Ga., will erect a plant to cost $75,000.

The National Woolen Mills Co., Parkersburg, W. Va., will build an addition to its plant.

The Alexander Cotton Mills, Alexander City, Ala., will increase the equipment of its plant. Estimated cost, $150,000.

The Southern States Bag Co., Jacksonville, Fla., recently organized, will shortly begin the erection of a plant. Present address is 9 Jefferson St.

WEST OF THE MISSISSIPPI

Mark Sleeter, of Burlington, Ia., will build an ice-cream factory.

The plant of the Fenton (Mich.) Canning Co. was destroyed by fire. Loss, $10,000.

The plant of the Riverdale (Utah) Canning Co. was destroyed by fire. Loss, $33,000.

The Hub City Brick Co.'s plant, at Centralia, Wash., was burned with a loss of $8000.

The city of Gold Hill, Ore., has voted bonds for $25,000 for the installation of a water-works plant.

The Scott Graff Lumber Co., of Duluth, Minn., will make improvements to its plant, costing $40,000.

The M. T. sawmill, owned by Adolph Carlson, at Two Harbors, Minn., was burned. Loss, $30,000.

Pierson & Page, Medford, Ore., plan for the erection of a modern fruit-packing and storage plant.

The Corning (Calif.) Cold Storage plant was destroyed by fire. The company plans to rebuild.

The Leoncita Ranch, Alpine, Tex., plans for the installation of pumping plants and an irrigation water system.

The Mitas Fruit & Land Co., Bloomington, Calif., contemplates the installation of new pumping machinery.

The lumber plant of the Potlatch Lumber Co., Tekoa, Wash., was destroyed by fire with a loss of about $11,000.

The Sanitary Laundry Co., Herman St., San Francisco, Calif., has taken out a permit to build an addition to its plant.

The Simmons Brick Co., Los Angeles, Calif., has taken out a permit to build an addition to its plant on South Boyle Ave.

H. C. Watson, Bieber, Calif., operating a creamery plant, plans for the erection of a second creamery plant at McArthur, Calif.

The cotton-ginning plant of the Calexico (Calif.) Cotton Gin was totally destroyed by fire. The plant will be rebuilt.

Frank Ziyc, McNeal, Calif., plans for the installation of a pumping plant in the Sulphur Springs Valley, in the near future.

The Commonwealth mine, Washoe, Nev., will make improvements and additions in its power plant. C. N. Miller is general manager.

Colonel Olmstead, Salem, Ore., plans for the erection of a modern laundry plant, at Portland, Ore. The plant will be fully equipped.

A franchise for a gas plant was granted Frank Ployhar, at Valley City, N. D., who will start active construction work in the spring.

A. C. Larson, East San Pedro (Los Angeles), Calif., has taken out a permit to make improvements and additions in his boat-building plant.

The plant of the Lacy Carpet Cleaning Co., Anderson St., Los Angeles, Calif., was partially destroyed by fire. The plant will be rebuilt.

The city council, Los Angeles, Calif., plans for the erection of a municipal asphalt-manufacturing plant. The city engineer is in charge.

Walker Brothers, American Cañon, near Fitting, Nev., operating mining properties, plan for the installation of new hoisting machinery.

Contract has been let for the construction of a five-story factory for the Iten Biscuit Co., at Washington and Congress Aves., Oklahoma City, Okla.

The Carney mine, Ray, Ariz., plans for the installation of new power drills and air-compressor machinery. P. C. Carney is head of the company.

The Muscatine Oil Co., Maricopa, Calif., plans for extensive work in oil-drilling operations on its properties. Machinery for drilling will be installed.

The Fresno (Calif.) Water Co. plans to increase the capacity of its waterworks plant. New equipment will be installed. J. T. Newlin is in charge.

The Imperial Manufacturing Co., Portland, Ore., plans for the establishment of a woodworking plant, at Oxnard, Calif. W. E. Halbert is manager of the company.

The California Northern Telephone & Telegraph Co., Susanville, Calif., will build a new telephone-exchange plant, at Nevis, Calif. William Hills is manager of the company.

Ferneding & Haskell, Woodburn, Ore., contemplate the erection of a modern sawmill plant on timber property, near Hillsboro, Ore. George Ferneding is in charge of the work.

The Independent Fruit Packers' Association, Anaheim, Calif., has acquired the Grimshaw packing house. The new owners will build an addition to the plant and increase the capacity.

The Evening Express Co., Los Angeles, Calif., will build an addition to its newspaper-printing plant. The plant will be used as an auxiliary-press and linotype-machine room, and will be fully equipped.

R. A. Johnson, Klamath Falls, Ore., formerly general manager of the C. A. Smith Lumber Co., plans for the erection of a woodworking plant for the manufacture of sash, doors and similar specialties.

The Pacific Packing Co., Los Angeles, Calif., has acquired the fruit-packing house of the Ely-Gilmore Co., at Pomona, Calif. The new owners will increase the capacity of the plant and install new equipment.

The Castlerock (Wash.) Coal, Light & Power Co. is having plans prepared for an electric power plant and a modern coal-mining plant to be installed at its properties, near Castlerock. The work is estimated to cost $275,000.

The Agutter-Griswold Co., Seattle, Wash., manufacturer of electrical equipment, switchboards, cabinets, etc., plans for the establishment of a branch manufacturing plant, at Vancouver, B. C. A. E. Griswold is in charge of the work.

The Sulphur Springs Valley Deep Well Co., recently incorporated, with headquarters at Douglas, Ariz., plans to drill for water, and for the installation of pumping plants in the Sulphur Springs Valley, Ariz. Frank Doan is head of the company.

The Todd Hydro-Electric Power Co., Tombstone, Ariz., has been incorporated by George N. Todd, Francis D. Crable and Aura G. Bernard, with a capital of $5,000,000. The company plans for the erection of a large hydro-electric power plant, near Tombstone.

The Mountain States Telephone & Telegraph Co., Billings, Mont., plans for the construction of a system between Judith Gap and Broadview, Mont., a distance of about 100 miles. The company will also make improvements and additions in its local exchange plant and system to cost $50,000. Mr. Owens is local manager.

The Kittitas Ry. & Power Co., Roslyn, Wash., plans for the erection of a hydro-electric power plant in connection with its proposed electric-railway system into the Cle Elum mining district. The work is estimated to cost $1,500,000. The Brown Co., consulting engineer, Bailey Building, Seattle, Wash., is in charge of the work.

James A. Green & Co., engineers, South La Salle St., Chicago, and Overland building, Boise, Idaho, plan for the installation of a pumping and irrigation works system in the Snake River district, Malheur County, Ore. The work is estimated to cost $46,000. The company is said to be in the market for pumping machinery, electric motors, etc.

The Feather River Power & Irrigation Co. has been incorporated at San Francisco, Calif., by R. K. Barrows, A. N. Lewis, Jr., A. H. Dahl and F. C. Van Deinse, with a capital stock of $10,000,000. The company plans for extensive operations in power and lighting enterprises in the Feather River district. Principal offices will be at San Francisco.

The Gila Valley Milling Co., Safford, Ariz., recently incorporated, has acquired the flour-milling plants of the Valley Milling Co., at Safford and Solomonville. The company plans for extensive improvements in the plants, and for the erection of a second large milling plant at Safford. A site for the latter has been acquired. F. L. Ginter is general manager.

CANADA

The Flesher Marble Co. will equip a big branch plant at Calgary.

The Regal Flour Mills Co. will locate a new plant at St. Thomas, Ont.

Carleton Place contemplates installing a new $200,000 water-works system.

The canning factory of J. C. and M. C. Smith, Burlington, Ont., was destroyed by fire.

The R. S. Williams Piano Co., of Toronto, will make big extensions to its factory.

Tenders are being asked for the building of an electric substation by the city of Hamilton, Ont.

Fire destroyed $25,000 worth of machinery in the plant of the Dowd Milling Co., at Quyon, Que.

The Kingston Mica & Phosphate Co. will purchase a quantity of new machinery for developing its property.

The Cosgrage Brewing Co., of Toronto, will make big extensions to its brewery and install the latest equipment.

The Brunswick-Balke-Collender Co., manufacturing billiard tables, will erect a factory, in Toronto, to employ 300 men.

Plans are being prepared for the erection of a tanning factory to cost $13,000, for W. B. Levack, 1189 Bathurst St., Toronto, Ont.

Leitner, Euwecke & Peters, of Winnipeg, will equip a new brick-making plant, at Calgary. Machinery to be bought at once.

The sawmill plant of the Reid Sawmill Co., Quesnel, B. C., was recently destroyed by fire with a loss of about $15,000. It is said that the plant will be rebuilt.

FOREIGN

The Pearson Corporation, Pearson, Chih., Mex., plans for the erection of an electric power plant near Pearson. Electric-lighting systems will be installed at Colonia, Juarez, Colonia Dublan and Pearson. An electric tramway system is contemplated between Colonial Juarez and Pearson. F. S. Pearson is at the head of the corporation.

MINING

Five more stamps will be installed at the Gold Pyramid mine, in the Porcupine district, Ontario, Canada.

J. W. Weaver and C. B. Guinn, of Carthage, Mo., have bought the McFeran mine, near Carl Junction, and will erect a new mill.

The Four Hills mine, near Downieville, Sierra County, Calif., has been bonded to F. H. Wedekind, of San Francisco, who intends adding a cyanide plant.

The Searles Mining & Milling Co., composed of Los Angeles men, has purchased the Bonner & Dexter mine, in the Radamacher district, Kern County, Calif. A stamp mill is said to be contemplated.

BUSINESS ITEM

The Lumen Bearing Co., brass founder, Buffalo and Toronto, has made some recent changes in its organization, as follows: H. P. Parrock, formerly western representative, has been appointed sales manager, succeeding Allen Kendall, resigned. H. F. Russell, formerly purchasing agent, has been appointed sales representative, covering central and western New York and eastern Pennsylvania. Albert Lockwood succeeds him in the office of purchasing agent. Louis S. Jones, for many years with the Prentiss Tool & Supply Co., has been appointed sales representative in New England. H. O. Schwaner has been appointed sales representative in the Pittsburg district. Fred Ganderton, formerly with the Aluminum Castings Co., has been appointed sales manager of the Toronto plant.

CATALOGS WANTED

E. C. McHugh, 101 North Shore Drive, South Bend, Ind., would like catalogs from manufacturers.

FORTHCOMING MEETINGS

Society of Automobile Engineers. Annual convention, New York City, Jan. 18-20, 1912. C. F. Clarkson, general manager, 1451 Broadway, New York City.

American Society of Engineer Draftsmen. Regular Meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Hotel Bellevue. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month, Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Calipers: Welles Caliper Co., Milwaukee, Wis.

Caliper catalog free. E. G. Smith, Columbia, Penn.

Sachs' standardized tool requisitions; mechanical drawings. J. J. Sachs, Lynchburg, Va.

We buy or pay royalty for good patented machine or tool. Box 282, Am. Machinist.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Technical patents a specialty. G. M. Sacerdote, engineering patent attorney, 1919 Broadway, New York.

We build to order light machinery, tools, jigs, subpresses and dies; high-grade work. The Elgin Tool Works, Elgin, Ill.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Drafting work solicited. Patent drawings; mechanical and general designing. E. Smith Co., Box 655, Am. Machinist.

Who manufactures in large quantities auto rivets, bored and hardened? Offers under Ke. 2381, to Rudolf Mosse, Elberfeld, Germany.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Machine work, machine models, patterns, forging gears, pumps and engines built or repaired. Clark Machine Co., St. Johnsville, N. Y.

High-grade machine work in quantities for gear cutters, hand turrets, milling machines, etc., wanted. The Seneca Falls Mfg. Co., Seneca Falls, N. Y

Want a good, responsible machine shop to build and market a new patented line of heavy machine tools on royalty. Box 700, Am. Machinist.

Tool tempering chart, 13½x1½ inches, printed in colors with full description; 10 cents postpaid. Spon & Chamberlain, 123 Liberty St., New York, publishers.

Small shop holding valuable automatic machine tool patents, desires machinery agency to finance expansion necessary for manufacture and sale of same. Box 620, Am. Machinist.

For rent—Moving into new plant, will rent present adjoining factory with large modern brass foundry; cheap electric power; 15,000 square feet; rent low. Rushmore Dynamo Works, Plainfield, N. J.

Simple, meritorious inventions bring profits, often fortunes; mail description of your invention for free, candid opinion and estimate to apply for patent. E. P. Thompson, M.E., Victor Bldg., Washington, D. C.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan, is wanting good agencies for machine tools of all kinds. Box 189, Am. Machinist.

A strong, old established manufacturing company, with a national selling organization, wants to add a new line of building material or construction specialty to manufacture and sell. Address "X," Box 617, Am. Machinist.

Second-hand milling machine that is in first-class condition of the size and quality of the No. 4 Cincinnati plain miller with vertical head attachment wanted. Write description and full particulars of what you have to offer, together with price, to the Campbell Motor Co., Wayzata, Minn.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Company, Inc., 40 West 13th St., New York City.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

GENERAL MANAGER for a Canadian foundry employing some 500 men, to take charge of production and sales under the president; no one should apply who cannot show a thoroughly successful record in a similar position. Applicants should have practical knowledge of heating appliances, boilers and radiators, and be able to plan production on sound and economical lines; state full particulars of technical and commercial experience, age, present salary and salary asked; the right man will be treated liberally; all applications will be treated in strict confidence. Box 711, Am. Machinist.

DELAWARE

ASSISTANT CHIEF DRAFTSMAN—Large industrial corporation; applicants should have technical education and at least five years' drafting-room experience, and must have experience in handling men; experience in design of special and automatic machinery is essential, and, in addition, experience in one or more of the following branches: Powerhouse design, mill and factory construction, structural steel, acid works or other chemical manufacture; only men who can furnish the best of references as to character and ability will be considered. Apply, stating age, experience in full and salary expected, to Box 712, Am. Machinist.

INDIANA

FOREMAN for automobile road testing department; technical man preferred; state salary expected. Box 665, Am. Machinist.

MARYLAND

STRUCTURAL DRAFTSMAN, familiar with construction of steel barges, as leading man, also detailers. Address, stating experience and salary desired, Box 710, Am. Machinist.

SPOON MAKER—Must be experienced and familiar with uptodate methods of making retinned steel spoons, knives and forks; good opportunity for right man; give references. Address "Expert," Am. Machinist.

MASSACHUSETTS

SUPERINTENDENT—Energetic man to be superintendent of plant employing 200 men; technical training, experience with production and cost systems preferred. Box 732, Am. Machinist.

SUPERINTENDENT for a shop doing a structural and ornamental iron business; must have executive ability and a good idea of system. State age and past experience, giving references and wages expected. Builders Iron & Steel Co., 262 Bridge St., East Cambridge, Mass.

MICHIGAN

SUPERINTENDENT—Competent and experienced sheet-metal superintendent, to take charge of a plant making all sheet-metal work for high-grade automobiles; must be a good workman, accustomed to the machinery required in such a plant, and know how to manage men and get results; an honest man is more important than a genius; state experience, salary to start, reference, age, and all necessary information. Box 725, Am. Machinist.

MINNESOTA

LATHE HANDS, Gisholt; steady employment; good wages. Apply Campbell Motor Co., Wayzata, Minn.

MISSOURI

TOOL MAKER to take charge of tool room; must understand modern shop practice; state age, salary and references. Box 719, Am. Machinist.

NEW JERSEY

MACHINE SHOP FOREMAN, experienced on light iron and brass work; steady job; good pay to hustler. Box 698, Am. Machinist.

NEW YORK

ASSISTANT FOREMAN for machine and tool making shop located in western New York. Box 679, Am. Machinist.

MACHINE SHOP FOREMAN to take charge of about 15 men in general jobbing work; give reference and wages expected. Box 701, Am. Machinist.

SALESMAN—Man familiar with case-hardening trade to sell new, scientific composition; salary and expenses. Box 697, Am. Machinist.

PRESS SHOP FOREMAN, to manufacture small and medium size drawn articles from light gage steel; none but experienced and successful men considered; write in confidence, giving full particulars as to experience, age and salary expected. Box 682, Am. Machinist.

WORKS MANAGER—Old established and well organized company, employing about 1000 men, and manufacturing a high-class product, wishes to secure a capable works manager of large experience in the production of small and accurate mechanisms, such as adding machines, typewriters, firearms, etc.; man under 40 years of age preferred; applicants are requested to give their experience in full; state age, positions occupied, and furnish list of references. To the right man a permanent position is assured at liberal salary; location, New York State. Box 693, Am. Machinist.

OHIO

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal pattern-makers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

OREGON

DIE AND TOOL MAKERS—Nothing but first-class skilled workmen need apply. United States Cashier Co., Kenton, Ore.

PENNSYLVANIA

INSTRUMENT MAKERS, first-class, for our experimental department. Write Westinghouse Electric & Manufacturing Co., employment department, East Pittsburg, Penn.

MACHINE SHOP SUPERINTENDENT, capable of managing small shop and making estimates. Must be willing to take part interest; shop located in live town in western Pennsylvania; good salary to right man. Box 695, Am. Machinist.

SUPERINTENDENTS—Two assistant shop superintendents at $5.04 per diem each; a competitive examination will be held at the navy yard, Philadelphia, Penn., January 8, 1912, for filling the above positions. For further information address "Commandant," Navy Yard, Philadelphia, Penn.

OPERATOR—Bilgram gear generator operator, experienced on cutting automobile bevel drive gears and pinions; only thoroughly competent men need apply; state experience and wages expected. Standard Roller Bearing Company, Philadelphia, Penn.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

ACCOUNTANT—Able to install and operate a cost or bookkeeping system; best of references furnished. Box 727, Am. Machinist.

MECHANICAL ENGINEER, graduate, 25, seven years' experience in machine shop and drafting room, wishes position; East or Middle West preferred. Box 704, Am. Machinist.

FOREMAN—By energetic young man; employed at present as foreman in large concern; a hustler capable of handling men; has had 10 years' experience on fine tool work. Box 723, Am. Machinist.

ILLINOIS

TOOL DRAFTSMAN AND DESIGNER, experienced on fixtures, jigs, dies, etc., for small interchangeable parts, thoroughly practical, has manufacturing department and toolroom experience, one year assistant foreman in toolroom, seeks position. At present employed. Box 702, Am. Machinist.

INDIANA

DESIGNER—Toolroom man with ability to design A-1 machines and fixtures, wants to earn $135 per month. Box 696, Am. Machinist.

SUPERINTENDENCY of an automobile plant or similar position; thoroughly competent and fully understands time study and rate setting; also standardizing of operations and shop organizing by a thorough mechanic in all branches; particulars on receipt of inquiry. Box 662, Am. Machinist.

MASSACHUSETTS

SUPERINTENDENT or general foreman; medium or light machinery, or mechanical devices, medium or fine grade. Box 728, Am. Machinist.

MICHIGAN

SUPERINTENDENT or factory manager is looking for a change; I am with a large auto truck company; I have organizing facilities, producing highest grade of work at low cost; a hustler with years of practical experience; would start at a salary of $2400 to show my ability. Box 703, Am. Machinist.

MISSOURI

MECHANICAL ENGINEER wishes position of responsibility; now employed as chief draftsman; salary, $2000. Box 694, Am. Machinist.

NEW JERSEY

DESIGNER, experienced on automatic machinery, dies, tools, etc., wants position. Box 483, Am. Machinist.

MECHANICAL DRAFTSMAN and designer; 12 years' shop and drafting experience. Box 726, Am. Machinist.

GENERAL FOREMAN or foreman; 10 years' experience as foreman and master mechanic; good executive; best references. Box 714, Am. Machinist.

FOREMAN, experienced in modern machine shop practice; specialist on tools and methods for reducing costs; tactful with men; first-class references; age 30. "Hustler," Box 734, Am. Machinist.

MECHANICAL ENGINEER wishes position as chief designer or draftsman; 32 years of age; a thorough mechanic; tool and general machinery; open Jan. 1, 1912; permanent position desired. Box 724, Am. Machinist.

SUPERINTENDENT—Position as superintendent or manager of machine shop about May 1; at present drawing a salary of $5000 a year; with present firm five years; with last firm ten years; reference if required; would consider a smaller salary along the Pacific coast. Box 708, Am. Machinist.

NEW YORK

MECHANIC—Experienced, for optical and electrical instruments, wants steady position. Box 715, Am. Machinist.

SUPERINTENDENT—Mechanical engineer, 38, German, 17 years' experience, desires position as superintendent. Box 729, Am. Machinist.

DESIGNING DRAFTSMAN, wide experience special automatic machinery, desires position near New York. Box 730, Am. Machinist.

HARDENER AND TEMPERER, also case-hardener, and all kinds of high-speed steels; best of references. Box 718, Am. Machinist.

FOREMAN—A-1 machinist on gasoline engine work to take charge of experimental work; able to handle men. Box 731, Am. Machinist.

DRAFTSMAN, ten years' practical experience; executive ability and originality; specialist automatic and paperworking machinery. Box 636, Am. Machinist.

DRAFTSMAN—Progressive designer with proved ability in improving and simplifying of automatic machinery; quick results without blunders. Box 720, Am. Machinist.

GENERAL SUPERINTENDENT, now employed, would consider change; practical machinist; good organizer; familiar with uptodate practice; first-class references. Box 688, Am. Machinist.

SUPERINTENDENT or machine shop foreman, 20 years' experience, medium and high-speed steam engines, boilers, pumps, etc.; good executive; hustler; reference. Box 689, Am. Machinist.

SALESMAN—Young man, 32, seven years' machine-tool business, four years' shop practice, all-round, desires position machinery trade as salesman or demonstrator; references. Box 706, Am. Machinist.

MECHANICAL MAN—American, 36, educated, experienced, steady, some means and patents, severing old connections, wants association with machinery manufacturing and selling concern. Box 707, Am. Machinist.

DESIGNING DRAFTSMAN is open for employment; experience Corliss steam engines, air compressor, rock drills, tools and fixtures; capable and ambitious; can furnish A-1 references. Box 685, Am. Machinist.

SUPERINTENDENT — Uptodate mechanical engineer and expert designer on automatic machines in the paper line, or position as superintendent, desires responsible position; 18 years' experience. Box 705, Am. Machinist.

SUPERINTENDENT, 16 years' experience in shop and drawing room; technical education; good original designer; acquainted with uptodate methods and tools and tactful with men; would consider change. Box 735, Am. Machinist.

ASSISTANT SUPERINTENDENT—Engineer of 12 years' practical experience in shop and drawing room, designing and building automatic machines and foundry equipment, wishes position as plant engineer or assistant superintendent; at present employed in similar capacity. Box 713, Am. Machinist.

OHIO

SALESMAN, experienced with machine tools and general machinery, with executive, commercial and practical ability, open for engagement. Box 709, Am. Machinist.

GENERAL MANAGER, fairly practical and experienced in the handling of manufacturing plants, consisting of main office and such departments as engineering, machine, foundry, blacksmith, boiler, wood and kindred departments; will take charge on salary or commission, or both, and with highest degree of productive efficiency; guarantee open shop and freedom from labor troubles. Box 687, Am. Machinist.

PENNSYLVANIA

TOOL DESIGNER for automatic lathes wishes to change his position. Box 699, Am. Machinist.

SUPERINTENDENT—Efficiency man for interchangeable machinery, moderate sized plant; handles men, reduces costs, turns out the work; 19 years' experience with first-class concerns, designing, cost figuring, systematizing; personal details and references by letter. Box 717, Am. Machinist.

MECHANICAL ENGINEER, with 10 years' practical experience and with inventive and executive ability; first-class designer, capable of developing and designing anything in the mechanical and structural line; would like position as chief engineer or chief draftsman; willing to invest some money with position; A-1 reference. Box 716, Am. Machinist.

FOR SALE

Engine builders—High speed reciprocating engine patent for sale; better than turbine; no promoters. C., 45 Park Ave., West Orange, N. J.

60x60-in. by 14-ft. William Sellers' worm-driven planer; four heads, with power feeds in all directions; nearly new; bargain to quick buyer. Address "X Y Z," Am. Machinist.

Double-end cutting-off lathe; will take 5-in. round bar; $50. Screw-cutting engine lathe, 14-in. swing by 6-ft. bed, with change gears and friction countershaft, $35. Box 106, Meriden, Conn.

$1500 cash and balance on easy terms to suit at 7% interest buys a completely equipped machine shop and foundry located in a live town of 17,000 in the midst of a section where work can be drawn from nearly every direction; shipping facilities are unsurpassed; splendid railroad service; the property, buildings, lot and equipment could not be duplicated for twice the asking price; an exceptional opportunity to step in and build up a big business. For full particulars, address Box 733, Am. Machinist.

Talks With Our Readers

By The Sales Manager

The Christmas holidays are to most of us the happiest season of the year.

This is as it should be—and this year is no exception.

We have a whole lot to be thankful for, notwithstanding the mist and uncertainty that have enveloped business for some time.

Things are never as bad as they seem—the dip is never so deep as it looks.

This is a great big country. No one but the statisticians in Washington realizes the magnitude of our products.

There cannot be far-reaching, unlimited hard times until the man next to the soil is affected. He is prosperous now.

Many of the large concerns of this country are busy. The ship-building industry is booming. Business in Europe is good. In England it is at the high-water mark.

Here, in future, there will be less boom and more straight hustle. There will be less scramble for anything that can be used and more intelligent seeking for the better things.

The great law of supply and demand is always working. Sooner or later we are bound to feel its full effects.

Machinery of all kinds must be used—it is needed to economically manufacture everything used by civilized man.

* * *

The golden rule is in better working order now than ever before.

The extremists at both ends of the social scale are fast losing their grip.

It is dawning on the man behind the machine that money does not make a man an ogre—that an employer has responsibilities and rights.

Capital is more and more realizing that "a man's a man for a' that"; that the rank and file are honest, want to be fair, although at times misled by unscrupulous leaders.

But the good fellowship that comes from contact one with another, the exchange of ideas, the putting of oneself in the other fellow's place, all tend to dispel the gray clouds, all work for the brotherhood of man which the Christmas season typifies.

Let us forget our troubles during this holiday season, and then each come back to our tasks with a clearer perspective, an effort that is strong, clean, hopeful and energetic.

Let us all have as happy a time as we possibly can. If our wish comes true, this will be the merriest of all Christmases to you and yours.

The Utilization of Scrap Materials

By C. W. Johnson*

Methods that are effecting important savings for a large electrical manufacturing company.

The features of the system are generally applicable.

*Assistant manager of works, Westinghouse Electric & Manufacturing Co., East Pittsburg, Penn.

The manufacture of electrical apparatus requires the use of a large number of different metals and alloys and necessitates their use in ways and combinations which make the separation of the scrap a difficult matter. In many of the machining operations it is impossible to avoid mixing copper, or materials of similar value, with iron or steel turnings. It is, of course, easy and not expensive to separate copper and brass from cast-iron turnings by means of a magnetic separator. It is not so easy or so inexpensive to remove a small amount of copper from long steel turnings, and it is similarly difficult to remove small amounts of iron from long, tough, manganese-bronze-turnings. As it is not possible to prevent such mixtures, this was, previous to the introduction of new methods, a source of a very considerable loss in value.

In the Motor Division

A consideration of one of the self-contained divisions of the works of the Westinghouse Electric and Manufacturing Company will be a help toward an understanding of the conditions. Let us take as an example the division manufacturing industrial motors of medium size. This is one of many divisions of the works in which a line of apparatus is made with practically no dependence on outside or feeder sections. This discussion is not concerned with arguments for or against what is known as the departmental plan of manufacturing of which this division is an interesting example, as that matter has been f lly discussed elsewhere. It need only be said that in this case the plan is particularly successful. In our consideration of the scrap question it will be shown that while complications were added, owing to the difficulties encountered in keeping the various materials clean and free from mixture, the principles of accounting and of departmental responsibility which are a part of the system have resulted in an increased value of the scrap.

The following materials are in daily use in this one division: Cast iron, cast steel, sheet steel and bar steel; copper in various forms, such as bare wire, ribbon and bars; copper insulated with cotton and rubber and treated with varnish and gums; various different solder alloys; babbitts of two grades; bearing bronzes having both zinc and copper as the base metal; standard red and yellow brass castings; special brass castings so alloyed as to give various percentages of electrical conductivity; aluminum copper, and aluminum zinc alloys.

The scrap resulting from working up all these miscellaneous materials must be kept free from mixture and clearly identified in order that its maximum value may be realized. Mixing may render the scrap practically worthless as in the case of aluminum or special conductivity metals. In order to appreciate the care required in this connection it must be borne in mind that there is only one machining section and that each machine tool must be used for work to which it is best adapted, and that, as a result, one tool may be used for widely differing materials in the course of a day.

Many thanks are due to the superintendent in charge of this division for the thorough and painstaking manner in which he has trained his workmen, the majority of whom are not high-grade mechanics; the scrap that is sent out from his department is almost perfectly sorted and classified.

These same conditions exist, with modifications, in each of the many divisions of the works. While each one has not reached as high a degree of perfection as the one described, there has been a decided improvement during the past three years and this improvement continues. It is the purpose of this article to describe briefly the methods or principles to which the improved conditions are due.

Details of the Methods

Previous to the time when the scrap question was taken up systematically the different materials were sorted and classified in the usual perfunctory manner by the shop and were then shipped to the brass foundry where they were received in a space that was inadequate in size and equipment and which was poorly lighted. As more scrap was received than could be utilized in making castings, only such material as could be used to the best advantage was selected for that purpose. The remainder was sold to scrap dealers, and of necessity at a low price when compared with its intrinsic value. Copper having tinned ends has a low value in the market, mixed turnings are a gamble, and the dealer is not usually one who will lose money. When copper in the form of wire is insulated and treated with gums and varnishes, its real value is uncertain. Scrap from special alloys brings a low price; manganese-bronze turnings are a good example. Solder and babbitt drosses are the scrap dealer's bonanza. It is not at all uncommon for large quantities of such dross, worth 20 cents a pound, on account of its high tin content, to sell for 2 cents per pound.

Fig. 1. The Method of Identifying the Scrap Metal

Fig. 2. Ladling Copper from the Refining Furnace

The above conditions existed at the beginning of the formation of the departmental divisions. As each was formed it was equipped with its own cost and accounting force, and its accounts were treated as if it were an independent concern. The immediate result was that costs and money values were appreciated by men all along the line, to whom such matters had not appealed strongly before. And this money influence, making it necessary to give money credit to each division for its scrap, also had a decided effect in preventing wastes and in forcing the credit to be as high as possible.

Simultaneously with this development, a separate building was erected and a division organized for receiving, smelting and refining scrap. In this building were provided: scales for weighing materials; a large floor for sorting; improved magnetic separators; a powerful lifting magnet, which is found to be useful in separating brass and copper from steel turnings and iron or steel chips from long copper or bronze turnings; suitable storage bins; a large sampling floor where 20,000-pound lots of turnings may be thoroughly mixed and quartered down for assaying; and various melting and refining furnaces.

With this plant equipped and operating and with each division of the works so organized that the results of its efforts were measured in dollars, the scrap situation went through a decided change. Scrap received by the smelting division is immediately weighed and valued and a credit is issued to the division where it originated. This credit is based upon the actual value of the material as received. If it is dirty, mixed and improperly sorted, the credit is reduced accordingly. In this way a powerful and very effective incentive is provided for keeping scrap clean. Constant effort is being made to find methods for utilizing materials formerly wasted. Aided by a competent corps of chemists and metallurgists, pronounced economies are constantly being effected.

The Various Economies Effected

The following are some of the things that have resulted in savings:

1. Steel and iron turnings are, as a rule, dumped from large steel buckets directly into gondola cars for shipments. Whenever traces of brass, copper or babbitt are noticed, the bucket is dumped on the floor and the more valuable metal is removed. This makes a direct saving, because the metal removed exceeds the cost of recovering by a considerable amount each month.

2. There is also an indirect saving, for the presence of these nonferrous metals, even in small quantities, lowers the value of the steel and iron and has frequently resulted in rejections and a reduction in price of two or more dollars per ton, as well as extra freight and demurrage charges.

3. The careful sorting and appraising of scrap when received have resulted in the return of much material to other parts of the shop for use in manufacturing. This is due to the fact that what is scrap to one is good material for another, owing to different conditions, and the scrap-receiving department furnishes an excellent clearing house for this purpose.

As concerns the manufacturing department, we have shown the things which have resulted in economies, as follows:

1. An accurate knowledge of materials received as determined by sorting or assay, and a careful appraisal for determining credit value.

2. An incentive for care and attention by giving credit in money values, which results in increased values when greater care is exercised.

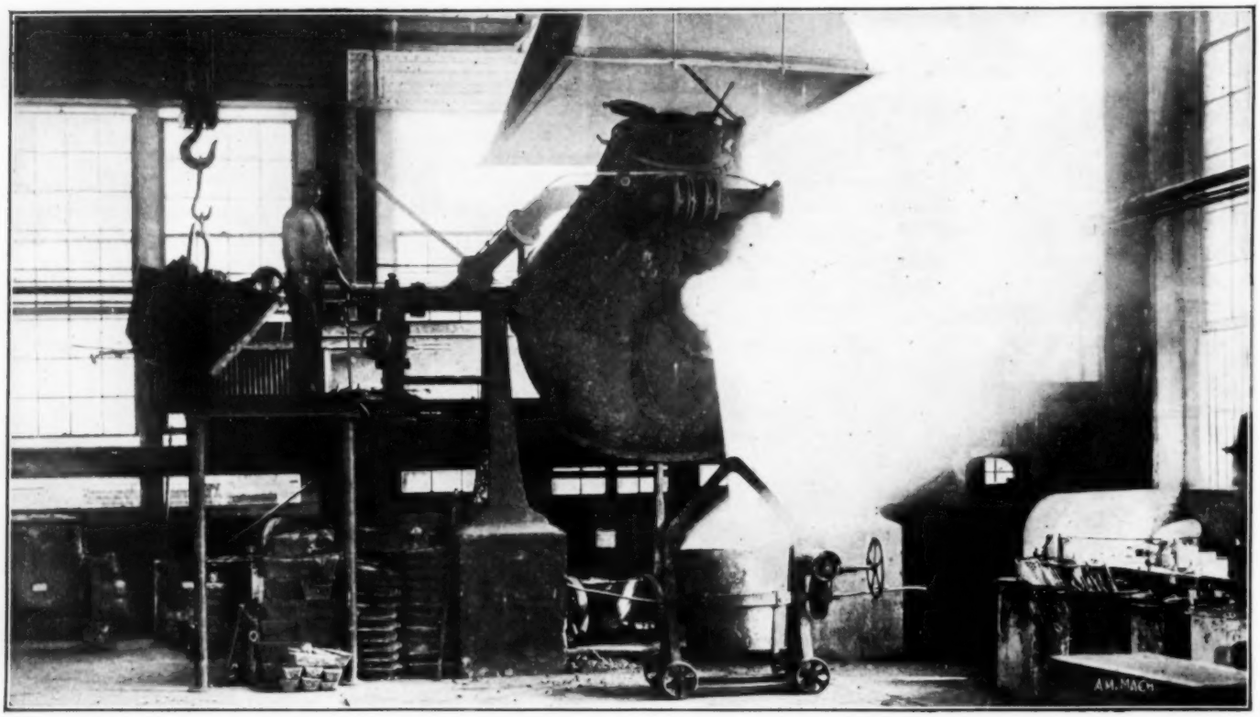


Fig. 3. Pouring a Heat of Brass from the Schwartz Furnace

3. Careful and judicious investigations develop new uses for materials which are frequently wasted.

The following are a few of the other means by which important savings have been made:

All scrap paper is sold, and pays a handsome profit on the labor required to sort it from other rubbish at the garbage furnace. Floor sweepings from all departments handling copper, solder and babbitt are rich in value, and it pays well to save them. Garbage-furnace ashes are sold at a price which produces an income rather than an expense for their removal. Lumber from packing boxes and from the receiving department is reclaimed by knocking the boxes apart and sawing off all parts containing nails. The good lumber is then cut into lengths

suitable for standard shipping boxes. In this way 100,000 feet of box lumber is secured each month at a cost of about three dollars per thousand feet.

No material is sold excepting after a careful investigation as to its metal value. This almost invariably results in a greatly increased selling price. In one case where a large quantity of very mixed scrap was for sale an offer of $6 per ton was received, and this was seriously considered as being a fair price. A complete assay, however, resulted in the sale at $20 per ton. In like manner, no scrap is refined unless a similar investigation shows a distinct increase in value by refining, over the selling price plus cost of refining.

The Benefit to the Brass Foundry

The effect of the smelting division has been of such benefit to the brass foundry that the subject may well be touched upon. The modern brass foundryman is called upon to produce a great number of alloys and it is yearly growing more important that he should be exact in his mixtures, so as to turn out a reliable and uniform product. These results cannot be obtained by preparing small heats on the foundry floor and especially so if scrap is used. Furthermore, no one who has it available can afford *not* to use scrap.

In the smelting division all scrap is melted in large quantities. The melting losses are accurately predetermined and new metals are added in the correct proportions. The mixture is then properly melted and refined and run into ingots of known analysis, corresponding to the alloy desired. By this method many advantages are gained. There is almost no variation in the analysis of castings of the same alloy number. The castings are more sound, clean and uniform. The melting time and charging labor are greatly reduced. Any surplus metal which may accumulate can be sold in ingot form at its intrinsic metal value, which is considerably higher than its scrap-selling value plus the refining cost.

The company has particularly appreciated the benefits which it derives from the large copper furnace. One of the most difficult problems which the electrical engineer has given the manufacturer is to produce copper castings of high conductivity. Beautifully sound castings can be made by the addition of other material, notably phosphor tin, but even a minute percentage is sufficient to greatly lower the conductivity. It is for this reason that the benefits of the copper furnace are so much appreciated, for it is now possible to fill the furnace with scrap coils, wire, cable, turnings, punchings, tinned ends and every kind of copper scrap and refine the whole, producing perfect ingots which show an assay of 99.80 per cent. pure metallic copper having a conductivity of 98 per cent. or better. As a large stock of copper is accumulated each month, it will readily be seen how much more valuable it is in ingot form than in the unrefined-scrap state.

European Machinery Building Trade

By August H. Tuechter*

Business conditions in Germany are good and are on a solid, substantial footing. England is experiencing unusual prosperity.

The strongest point in the European selling organization is the absolute knowledge each member has of the goods offered.

The personal visit is an essential in selling in the foreign field; often the small plants and outlying districts offer better opportunities than the large cities.

*President, the Cincinnati-Bickford Tool Co.

The widespread interest shown in this country in regard to European machinery building and development, especially German machine-tool building, has prompted the asking of many questions in regard to the European machinery situation. During a recent three-months' trip covering Continental Europe very thoroughly, I was enabled to study the situation at close range in all the important countries, with the exception of Russia.

Taking up the purely commercial side first, the machine-tool business in Germany and throughout Continental Europe in general is good. In Great Britain recent advices state that they are experiencing unusual prosperity. The recovery from the depression of the past two or three years seems to be complete, everybody is busy, business is of the best. On the Continent, conditions are on a solid, substantial footing, but are not booming.

Far-sighted American machine-tool builders, perceiving the value of foreign trade, have reached out into the markets beyond the borders of the United States. There is no question as to the wisdom of fostering export trade. Undoubtedly, business from such sources is one of the most stabilizing factors that can be employed, in spite of the fact that the last business depressions have seemed to be worldwide though not necessarily simultaneous in all countries. Thus, if a firm is drawing its business through a number of channels reaching beyond the home markets, disturbed business conditions of one nation will not tend to cut off the entire volume of orders, as would be the case if the entire market was at home and business conditions there were bad. I believe that this is a point that should be most vigorously emphasized. Foreign trade is a great stabilizing factor in any industry.

To act upon this belief, it is of value to consider some of the ways in which Germany has built up her extensive foreign business. Today she is one of the great exporting nations of the world. At the outset she caters to export trade and enters practically all of the foreign markets. A restricted home market has been one of the reasons for this extension, and a clear appreciation of the value of foreign orders has been another. German business agencies are scattered all over the world. Here are direct representatives of the home manufacturers, trained in the technical knowledge of the products being sold and possessed of a first-hand acquaintance with the foreign field.

These representatives are usually young Germans, who, after having been through the shop or office at home, have been sent to the foreign field to learn the language and customs of the people there, and in a systematic and thorough way push forward the sale of Germany's products.

The Strongest Point of the European Selling Organization

In the above I have mentioned what I believe to be the strongest point of the European selling organization. This is the absolute knowledge on the part of all of its members of the products which they are offering. The strong regard that the German has for knowledge for its own sake, his traditional thoroughness, and government requirements that statements in regard to products as set forth in catalogs and advertising matter must be true and capable of being substantiated, are aids in acquiring this absolute knowledge. Every member of a German selling organization knows his goods. This

complete knowledge is a great element of strength to a salesman when he meets a prospective customer.

As Europe is our most important, foreign machine-tool market, a word should be said about the lines of machines that have the best field there. Turning first to our standard types, these undoubtedly have a very fair field in all European countries. This applies to regular types of machines which have been manufactured in America for many years, and in most cases have been specialized on and developed to a high degree of general excellence. However, such machines are more easily designed by others along parallel lines or, more bluntly put, copied; and this has been done. European manufacturers have an advantage in more favorable prices for material and labor and these standard products compete very keenly with those of American manufacturers.

Turning now to special machines, semi-automatic, automatic and others that have been developed in this country because of the necessity of saving high-priced labor, these have a better field than the standard machines. European countries have today and always have had cheap labor. Thus, they have not been compelled to develop highly organized machine tools. It is, therefore, perfectly natural and, in fact, very wise on their part to buy from us. We have been through the experimental work of designing, constructing and perfecting such machines, and they find a more ready sale than those of simpler design. Another feature of importance in this connection is the protection afforded by patents. This is considerable in most European countries, especially in Germany.

In considering either type of machine, whether the standard or automatic, it should be kept in mind that the small trade centers offer a better opportunity for business than the larger cities—this is perfectly natural, for the competition in the larger cities is much keener than in the outlying districts.

Features of Design

Numerous questions have been asked in regard to the comparative design of European and American machines. Those of standard types, such as lathes, planers, millers, shapers, drillers, etc., compare very favorably with the American. In many cases differences in details of design and constructional features are very hard to detect. In this connection it may not be out of place to point out that among such machines from some American makers, there are not as many differences as might be suspected before a careful examination was made.

In no case did I notice any particular design differing in its main features from our similar designs. In minor details, however, there are differences. A supposed difference between European and American materials is often referred to. I do not believe that this difference exists, and my belief is substantiated by the fact that some time ago we imported both European cast iron and steel, conducted tests and found very little difference between them and the corresponding American products.

Referring to the rather delicate subject of workmanship, in some cases I found the workmanship on European machines very good indeed, and equal to that on many American machines. In other cases, I found it to be of poor quality. Insofar as the superficial finish is concerned, as a general thing, it is better on American machines than on European.

With them standardization and specialization have not been carried very far. At least, these features were not apparent to me. The average machine shop there builds a large line of different machine tools and is very ready to undertake the constructing of specials. This very fact is an element of strength to American competitors. Although if Germany, in particular, continues to absorb a large proportion of the increasing foreign trade, her manufacturers may be able to specialize in the same way that we have done with the accompanying advantages. Thus far, however, American machine-tool development and design has influenced the world-wide industry to a very great degree.

The shop-management wave that has been going over this country has no counterpart in German industry. It is possible that it may never have, for the German social and industrial philosophy is far different from ours.

In general, European factories compare very favorably with ours. Their buildings will average better excepting our most modern types of fire-resisting construction, provided with large window areas and the best of facilities for heating, ventilating, artificial lighting, sanitation, etc.

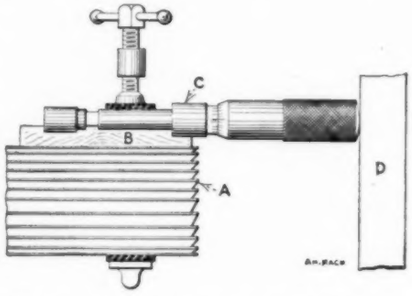
Some of the plants that I visited were as modern in all respects as the best that we have in this country. Others were as good as our average here, and to complete the picture I must say that I have visited some which were about equal to our worst. All of this simply means that the average European shop compares very favorably with the average American shop.

Finally, and returning to the commercial viewpoint, undoubtedly the best results in obtaining foreign trade are by personal visits to the countries in which the foreign markets are located. The personal interview and personal solicitation are important. It is, perhaps, needless to say that a knowledge of the language of the country is an essential.

A Simple Micrometer Indicator

By A. G. Spark

It frequently happens that finished surfaces have to be re-machined in the miller, planer, etc., and it is important that these faces or surfaces be lined up parallel to the travel of table, to insure an equal amount of stock being removed all over the piece. The accompanying



Using a Micrometer as an Indicator

cut shows a useful substitute for an indicator for the purpose. It is old, but none too well known.

An end mill *A* in the miller has an ordinary micrometer *C* clamped against it. A piece of wood *B* intervenes to save the "mike." The work *D* is to be machined. Unscrew the micrometer until the end of the thimble touches the work, and note the reading; move the thimble back from the work, then advance the table to bring the other end of the work in line with micrometer, then note the reading when the thimble is again brought out against the work. Repeat these operations until the difference between the readings is within the accuracy required. Needless to say, this arrangement is applicable in a variety of ways.

Where the number of cores used per molder is so great that the weight of the cores delivered to each approximates the number of pounds of castings turned out by him per day, the problem of transporting the cores becomes serious and must be taken into consideration in locating the core room. In this there must also be considered the element of breakage. Every core that is broken represents not only the loss of the sand and binder but also of the time expended in making it, the fuel for baking, and other labor in the way of transportation. Brass and bronze have a greater shrinkage than iron. The patterns for brass and bronze must have a shrinkage allowance of $\frac{3}{16}$ inch per foot, or in other words, if a shrink rule is to be used the bar to be graduated to equal 1 foot must be $12\frac{3}{16}$ inches long. This bar is divided into 12 parts to represent inches, and the inch into eighths or sixteenths, as may be required.

The Panama Canal Shops at Gorgona

By Fred H. Colvin

"Making the dirt fly" at Panama means the keeping in repair of locomotives, cars, cranes, drills, steam shovels, dredges and other machinery. This is entirely up to the mechanical department.

The shops at Gorgona employ from 1500 to 1800 men, about 700 of them being good mechanics, the rest helpers and laborers. The work combines that of a large railroad repair shop, foundry and pattern shop, and whatever general repairs have to be made.

The largest shop on the Isthmus is at Gorgona, which is approximately midway between Colon and Panama, so as to be central. Here the manufacturing and general repair work are done on all machinery excepting the steam shovels, these being repaired at Empire. A general view is seen in Fig. 1, though this was taken before additions at the left were made. Fig. 2 gives an idea of the locomotives and cranes which are used.

A. L. Robinson, the superintendent of shops and machinery on the Isthmus, is located at Gorgona, although he makes frequent visits to other points on the line. It is interesting to note that the house he occupies is within a very short distance of the one originally erected for the younger DeLesseps, who was located at this point when the French work on the canal was at its hight.

The Gorgona shops are very complete in many ways and take care of the general overhauling of all locomotives; the heavy work on dredges, which can sometimes be done more advantageously here than at either end of the canal; leveling machines and the manufacturing of such articles as must be made in any case of this kind. Wherever possible, standard machinery has been used and there has been no attempt to manufacture any more than has been absolutely necessary, as in most cases, it is obviously cheaper to buy machines from those who make a business of manufacturing them.

It must be remembered, however, that it is seven days from New York and five days from New Orleans, which means a long time between the mailing of an order and the receipt of goods, even if they happen to be in stock and can be shipped promptly.

The question of manufacturing has received careful consideration, and is only done where the delay to the work will be much more serious than the additional cost of manufacturing under adverse conditions.

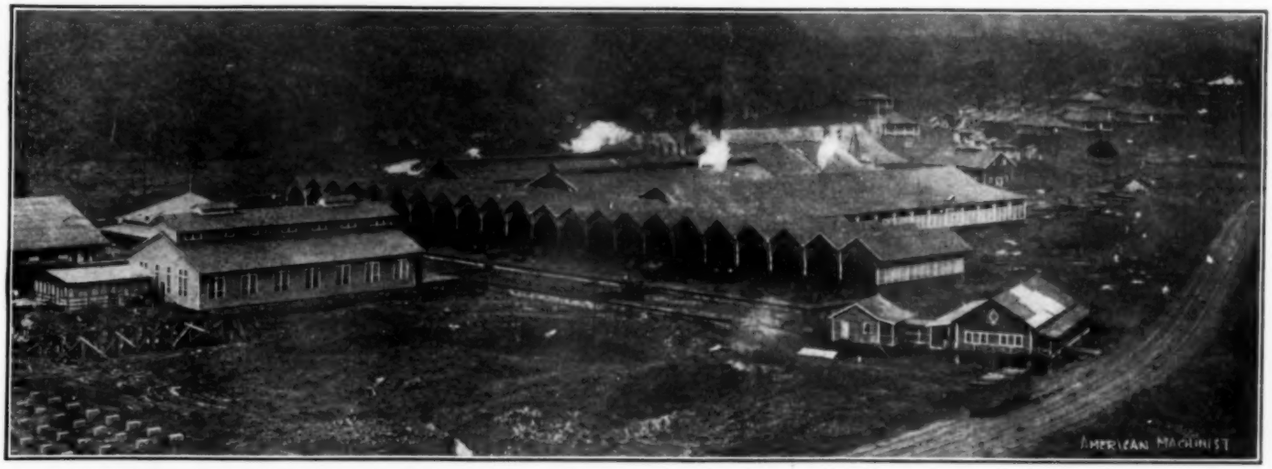


FIG. 1. GENERAL VIEW OF THE GORGONA SHOPS

PART OF FRENCH SHOP STILL USED

A part of the shops at Gorgona is a remnant of the French regime, and has the same steel construction as will be seen later in the interior of Balboa shops; this is shown in Fig. 3. It is of steel construction and was very substantially built, but was not nearly large enough to handle the work that has been made necessary by the much larger scale on which the work has been done under American administration. It also lacked many conveniences, such as a drop pit for locomotive drivers, but this and others have been provided.

The only foundry on the Isthmus is located here, there being two Whiting cupolas of 10 tons capacity, and by this time they are in condition to make steel castings which are being very largely used in steam-shovel repair work. At the time of my visit foundations were being put in for a 2-ton Tropenas converter, so that large steel castings could be made. The new converter will stand directly behind the cupolas, so that the metal can be taken from them, and put into the converter with the least possible loss of heat. The work is very largely special, so that molding machines are practically out of the question, and all the molding is done by hand.

Fig. 4 shows a view in the foundry which includes the business end of a substantial crane which was built here very largely from material found in the scrap pile. As can be seen, there is ample gear reduction so that very heavy loads can easily be handled, even though slowly, and it has proved very satisfactory indeed.

The crane shown serves the old portion of the foundry. The new part was formerly the pattern storage, which has been turned into a foundry for comparatively light work, and is served by an overhead traveling crane.

In the background is the cope of a mold for a large propeller for one of the steam-driven vessels used at each end of the canal, while at the left is a familiar picture of a flask ready to be poured and loaded down with pig iron to prevent the raising of the cope.

FIG. 2. YARDS AT THE GORGONA SHOPS

FIG. 3. INTERIOR OF SHOP, SHOWING FRENCH STRUCTURE

USING CORAL AS A FLUX IN PLACE OF LIMESTONE

Fig. 5 shows a corner of the yard outside of the foundry. The rocks in the foreground are coral, which has been found to make an excellent flux in the cupola, and as it could be obtained much more easily than limestone, it is used exclusively for this purpose. It comes from Colon, 28 miles away.

The foundry is particularly fortunate in securing all of its material except coal in nearby places. A fine bed of molding sand was found only a quarter mile away on the banks of the Chagres river, which has become famous for its violent temper during floods in the rainy season, but which seemed to be perfectly harmless at the time of my visit. These both help in reducing the total cost of castings.

Behind these are some of the dumping cars which are in need of repair, as well as castings for spare parts. Still further back are piles of railroad ties, and in the extreme distance the mountains on the other side of the Chagres river, which forms the canal at this point.

CONCRETE CORE OVEN

Fig. 6 shows a concrete core oven which has been found very satisfactory and has been made large enough to handle a large number of cores. It is fired from the outer end and, as can be seen, the firing door is surrounded by fire bricks as a protection to the concrete. In the foreground is some of the lumber required in making patterns and in other woodwork, and at the left is a small woodwork shop under a "lean-to," which is a type of shop that is very frequently found in tropical countries. All that is necessary is to keep the sun and rain away from the wood, men and tools, as it never becomes necessary to have the sides closed against the cold.

A general idea of the brass foundry can be had from Fig. 7. This contains three oil-burning furnaces, air hoists and other appliances for facilitating the output.

OUTPUT OF THE FOUNDRY

The output of the foundry varies greatly according to the work done in the repair shops. The output of the iron foundry is about 15 tons per day, although at the present time it is less than this, owing to the work gradually diminishing all along the canal.

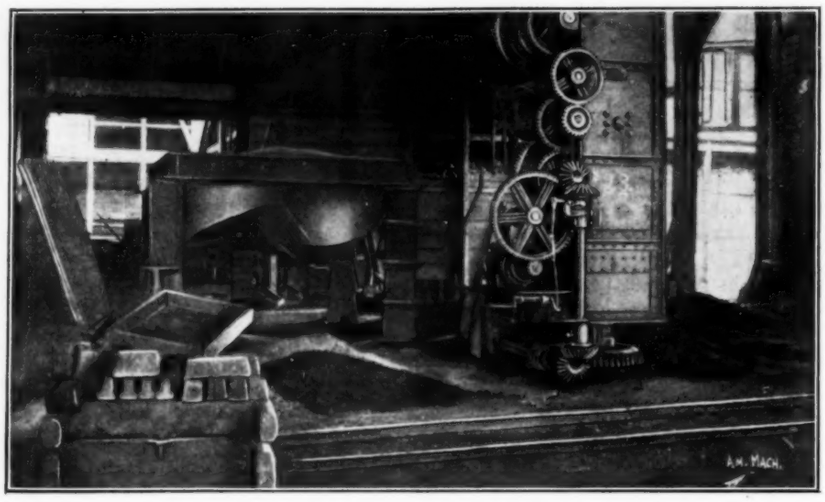


FIG. 4. A GLIMPSE OF THE FOUNDRY

FIG. 5. THE FOUNDRY YARD. CORAL FOR FLUX

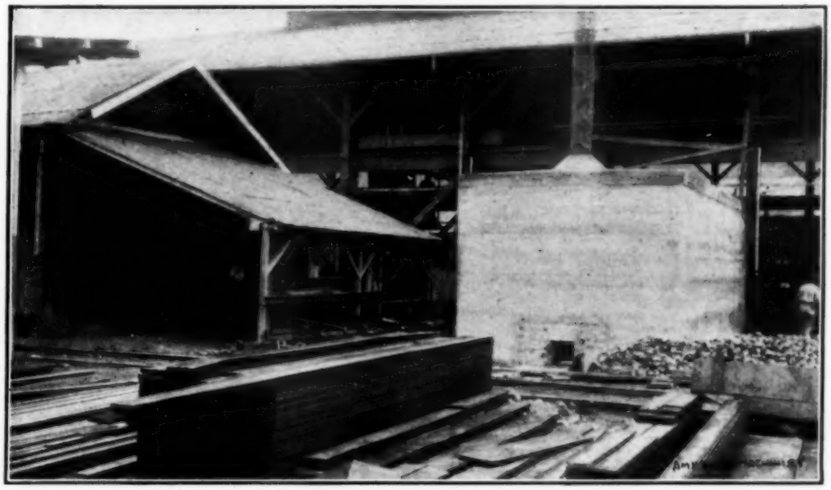


FIG. 6. CONCRETE CORE OVEN

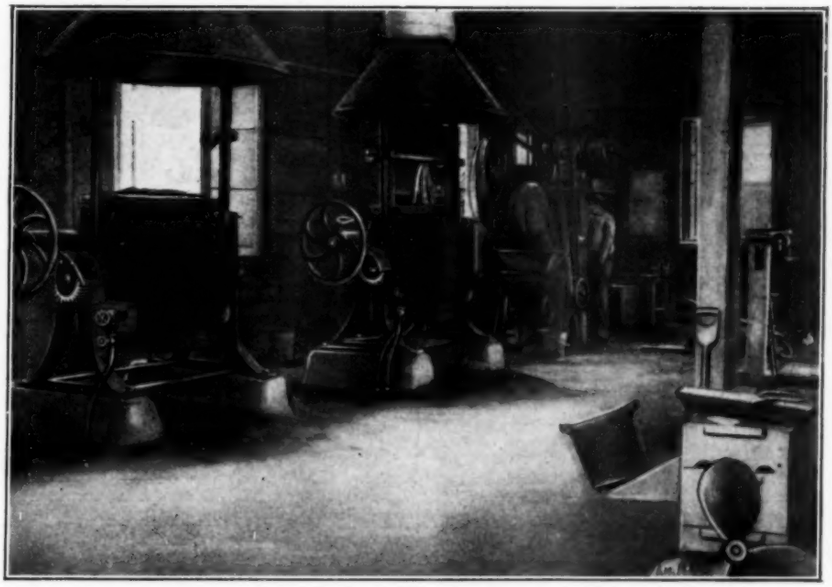


FIG. 7. THE OIL FURNACES IN THE BRASS FOUNDRY

The output of the brass foundry is about 18,000 pounds per month, while that of the steel cannot be figured until they know how extensively steel parts will be used to replace those that are now made of iron, owing to the difficulty in securing steel castings within a reasonable time.

They produce very good castings indeed, to judge from those made at various points along the line, and I was informed by the men in the different shops that they were exceptionally strong, on account of the use of a sufficient quantity of vanadium to produce the desired strength and purity of the iron.

It is interesting to note that in spite of the conditions and the high wage rate maintained, they are making iron castings at a cost of 0.02937 cent per pound, which includes the cost of the patterns and in the case of brass 0.1723 cent. No overhead is charged in either case.

EXORBITANT CHARGES FOR REPAIR PARTS

A view of the pattern shop is given in Fig. 8 and it will be seen that a large variety of work has to be done. Fig. 9 is a corner of the pattern storage warehouse, showing how patterns are kept, each one being indexed so as to be readily found. There are 10,500 patterns in this warehouse, nearly every one being made necessary by overcharging on the cost of manufacturers of the various kinds of machinery, mostly in the United States.

This is one of the most glaring examples I have ever seen on the folly of charging exorbitant prices for repair parts. I agree fully with those manufacturers who believe it is to their interests to assist in keeping their machinery at work at the least possible cost for maintenance to the user. They content themselves with charging a fair price on the cost of manufacture, and such storage charges as may be necessary in order to keep a supply of repair parts on hand.

When a machine shop located in the tropics and paying an average of 50 per cent, more for labor than in the States, can make patterns of gear wheels, propellers, pulleys and parts of all kinds, and can cast and machine them for less money than they can be bought from the manufacturers who make them in quantities, the prices asked can certainly be termed excessive.

This has meant not only an added expense to the Government in the building of the canal, but has also deprived the shops in the United States of thousands of dollars worth of work, which would have come in very handy in many cases. Setting prices on the basis that the consumer *must buy them at any cost* is hardly the way to secure the confidence of the user, and can hardly be called a good business policy.

FIG. 8. THE PATTERN SHOP

THE LOCOMOTIVES REPAIRS

All the locomotive repairing, belonging to the Isthmus Canal Commission, which means the locomotives used in actual construction of the canal, and also of the Panama railroad, are now repaired at the Gorgona shops. The Panama railroad is credited with having 70 locomotives, and the Canal Commission with 158 locomotives, varying from 105 to 117 tons each, besides over 100 smaller locomotives, so that it will be seen the repairs alone mean considerable work.

Add to this the fact that the Panama railroad has only 1¼ miles of straight track out of the 47 miles across the Isthmus, and you will readily see that the wear on tires is bound to be abnormal. Then, too, the track used for hauling the "spoil," as the dirt and rock is called, out of the cut is being constantly shifted and cannot be kept in good shape, all of which adds to the work necessary for proper upkeep. This track shifting is said to average about a mile a day.

Twelve of the locomotives used on the Panama railroad are oil burners, which are reserved for the passenger trains. And, in addition to these heavy locomotives used in the cuts, there are also a number of old French locomotives still in use handling cars around terminals where only light work is to be done, as well as a few narrow-gage American locomotives on what are practically industrial railways.

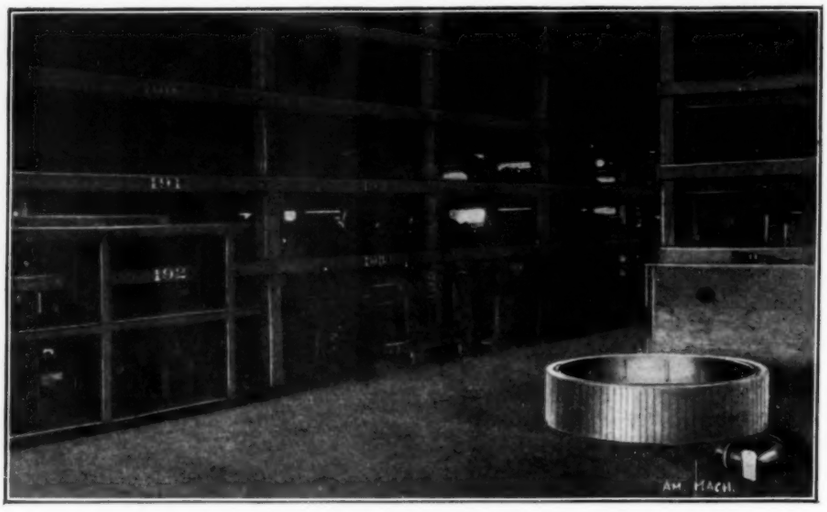


FIG. 9. THE PATTERN STORAGE

Fig. 10 shows a flue rattler which was made at the Gorgona shops out of old structural material, chains from the old French dredges, a three-cylinder engine from one source or another, and the necessary shafting and gearing, which all came from these scrap piles. There is nothing new about the machine, the flues being carried in the loops made by the chains and rolled around in the tank of water till the scale-making material has been loosened, as is the usual practice in locomotive shops.

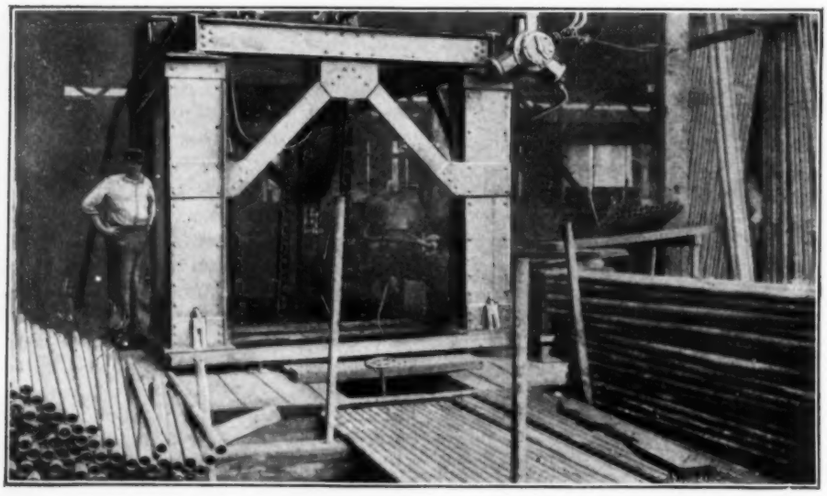


FIG. 10. FLUE RATTLER MADE FROM OLD MATERIAL

NEARLY ALL EQUIPMENT IS WEAK

Much of the locomotive-repair work is necessarily done under difficulties, as compared with a large, modern shop, such as will be built at Balboa for the permanent work for both the railway and the canal. Fortunately for these repair works, the locomotives seem to stand up to the work much better than almost any other machinery which has been supplied. With very few exceptions, every steam shovel, crane and car which has been sent down to the Isthmus for the canal work has been found weak, and it is a regular practice to strengthen them before putting them into service.

In the case of the cars the steel sides are reinforced by using old French rails, which seem to grow with the rapidity of tropical vegetation all over the Isthmus. Whoever had the placing of orders for steel rails in the old French days either had exaggerated ideas of the amount of rails which were necessary or there were other pressing reasons, which are responsible for hundreds of tons being ordered, which were never laid in tracks.

STRENGTHENING STEEL CARS

The corner of the shop shown in Fig. 11 is where the sides and doors of the dumping cars are being strengthened by riveting rails across the top and bottom to act as strengthening beams. These are riveted with the flat base next to the side

of the car and they make admirable stiffeners for this purpose.

As the supply of these rails seems to be almost unlimited, they are used in every imaginable shape, such as bridge building, reinforcements for concrete work, foundations for the steel converters and for forming the protecting corner of concrete sidewalks at the various towns along the canal route. In fact, it is hardly possible to go to any shops along the canal or to see any concrete work being done where these old French rails are not in evidence.

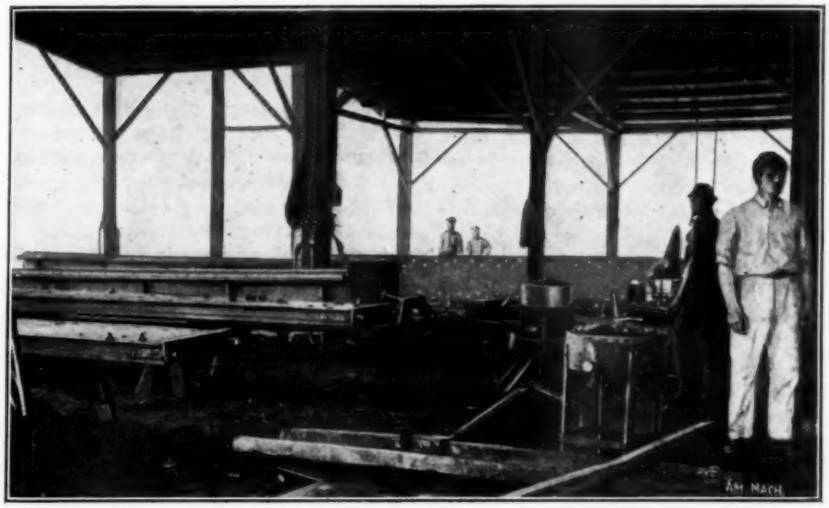


FIG. 11. STRENGTHENING STEEL DUMP-CAR DOORS

This may be a good point to mention one reason why it was found necessary to strengthen the cars, as well as why the repairs on the car occasionally runs to a higher figure than would be found in ordinary usage.

DYNAMITING ROCK TO UNLOAD IT

It is, of course, always the intention to have the rock broken small enough to pass out of the dumping door on the side of the car, but occasionally a piece gets in from one of the shovels which is too large to dump out in this way. This, of course, is not discovered until the train of cars is being dumped and it becomes necessary to get the cars clear in the shortest possible time in order to avoid delaying the work of getting the spoil out of the way.

So it has become common practice whenever this occurs for one of the men at the dumping ground to simply put a small charge of dynamite on top of the rock, then go back under the other side of the car and explode the charge. This shatters the rock so that it easily slides out on the dump. Incidentally, this usually puts a crimp in the car bottom if not the sides. It is a bit startling to have one of these "dobey" shots, as they are called, go off when you are in the vicinity of the dump, but we easily get accustomed to such things, just as we do to the continuous blasting in the vicinity of the canal, until we hardly notice either of them.

Modern Methods of Selling Machine Tools

BY JOHN R. GODFREY

I am pleased to believe that the sales department of some of the best machine-tool builders are being run on a higher plane than many other lines of business.

We are all familiar with the old maxim which has been drummed into salesmen's ears for many years: "Anyone can sell a man something he wants, but it takes a salesman to sell him something he does not want." Modern selling methods are proving this to be false. And more than that, modern salesmen, not correspondence-school teachers, but real, live, business-getting salesmen, are proving it to be absolutely untrue.

One of the most successful salesmen I am acquainted with, not only never tries to sell a man something he does not want, but urges a man against buying his machine if he feels that it is not the best machine for his purpose. He is not an idle dreamer, nor has he sprouted any wings which would put him in the "angel" class, but he has built up a splendid business working along these lines.

As a result of this policy, he has hosts of friends among users of machine tools, who know that they can depend on his statements and on his advice, and who do not hesitate to recommend him and the machine he sells whenever opportunity offers.

A CASE IN POINT

A recent experience along this line will show exactly how this works. My friend Jones called on a manufacturer who was in the market for a machine to handle a certain kind of work, and he asked Jones what machine he believed was best for that particular purpose. After making sure that this was the only kind of work which would be expected of the machine, Jones unhesitatingly recommended a machine built by a rival manufacturer, although the work could have been done on the machine Jones was selling. But for this particular work the other machine answered every purpose and cost considerably less money.

It so happened, although Jones did not know it at the time, that this same manufacturer was also in the market for a machine for work which could be handled best by the machine Jones was selling.

After Jones had gone out, the manufacturer sent for Mr. Brown, who represented the machine which Jones had recommended, told him his machine had been recommended by Jones, and gave him the order for it.

Incidentally Brown learned that there was room for another machine, and although he knew that the work could best be handled upon a machine of the Jones type, he endeavored to sell him two machines of his particular brand.

The manufacturer was so disgusted with the attempt to hog the whole field, as well as with the unfairness to him in attempting to sell a machine which was not well adapted for the work, that he came very near canceling the order for the other machine. And it is safe to say that Mr. Brown will have considerable difficulty in securing future business at this plant.

The old adage should be modernized something along this line: "Any man who sells a customer something he does not want is not a salesman, but a highway robber or a confidence man," whichever he prefers to be called.

And in this particular case, the manufacturer's respect for Mr. Jones increased several per cent., and he is sure to receive any further business which he can handle. Furthermore, he is pretty sure to mention the case to his friends and we all know how things of this kind act in influencing us almost without our knowing it.

The great peat deposits of the United States seem destined to remain an undeveloped resource for some time to come because of ignorance of their practical value. According to Charles A. Davis, in an advance chapter on the production of peat from "Mineral Resources of the United States," for 1910, which is issued by the United States Geological Survey, noteworthy progress was made in 1910 in the production of peat fuel in other countries not only in the quantity actually marketed but also in methods of production and utilization. It will evidently require a large amount of educational work to establish a full realization of peat possibilities.

Emergency Casting Equipment—II

By Henry M. Lane*

The selection of melting mixtures and influence of various constituents upon the quality of iron.

The methods of making patterns for iron castings.

Hints for foundry work.

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Selecting Scrap Iron for Melting

When pig iron is used as a source of supply for the cupola it is necessary to know its chemical composition, but in the case of emergency casting work the usual source of metal is the scrap pile, and hence a knowledge of the best way to sort and select scrap is of importance. The faces of chilled rolls and car wheels are hard and white because the metal they contain has been cast against a chill, and it is of such a nature that this treatment will keep the carbon in the combined form. Remelting chilled car wheels and casting them into sand molds will produce castings that are fairly soft, though the car-wheel mixture is always fairly tough and hard. The remelting and slow cooling give the carbon that was in the combined form in the chilled faces a chance to separate as graphitic carbon. Car-wheel iron is exceedingly strong and hence makes a good base for any ordinary machine parts to be made from cast iron. If a small amount of electric-furnace ferrosilicon containing 50 per cent. silicon is added in the ladle it will tend to make soft castings from car-wheel scrap or any other similar high-carbon hard mixture.

Car wheels are usually quite low in silicon and this is also true of heavy work such as engine flywheels, large rolls or anything over two inches thick. Much of this will run under 1 per cent. in silicon. Ordinary machine castings will run higher and stove plate will run close to 3 per cent. in silicon. A good grade of thin stove plate which has not been burned will melt down and cast into a soft gray casting and for this reason unburned stove plate may be used as a softener in iron mixtures.

Effect of Various Ingredients on the Castings

Each melting will tend to harden the iron by burning out some of the silicon and slightly oxidizing the iron. If the desired casting is, for instance, to be 1½ inches thick and 1-inch scrap is selected of the hardness desired in the 1½-inch casting, about the desired degree of hardness in the final casting will be obtained. The thickness of the metal is affected by the rate of cooling, and, as has been stated, slow cooling, like a high percentage of silicon, tends to throw the carbon into the graphitic form. If iron could be melted without reducing its silicon content the proper degree of hardness in a casting would be obtained by selecting scrap of the thickness required and of the hardness required, but since the silicon is reduced it is necessary to select iron of the hardness required and of a thinner section than the desired casting. The same results may be obtained by selecting iron of the desired thickness and hardness and then adding from a half to one pound of powdered 50 per cent. ferrosilicon to each 100-pound ladle.

A small amount of powdered 80 per cent. ferromanganese is also good material to introduce into the ladle, as it tends to clean the iron of sulphur and so produce soft castings. Burnt iron, such as burnt grate bars or burnt stove plates, should never be used in any castings that are to be machined, as the black oxide of iron which it contains is soluble in molten iron and renders it hard and brittle. The small cupola furnace will not reduce this oxide to metal.

Annealed malleable scrap should be avoided as this is practically wrought iron containing mechanically mixed carbon, and in most cases the cupola will not thoroughly re-incorporate the carbon with the metal. In large cupolas where so called semi-steel is to be made, annealed malleable scrap may be used together with wrought-iron or steel scrap. The object of using scrap of this kind is to dilute the silicon and to some extent the carbon in the metal and so make a tougher casting.

It is impossible to melt metal in contact with the fuel and have it come out with much less than 3 per cent. carbon. If metal containing a smaller amount of carbon is charged it will absorb carbon in passing through the cupola.

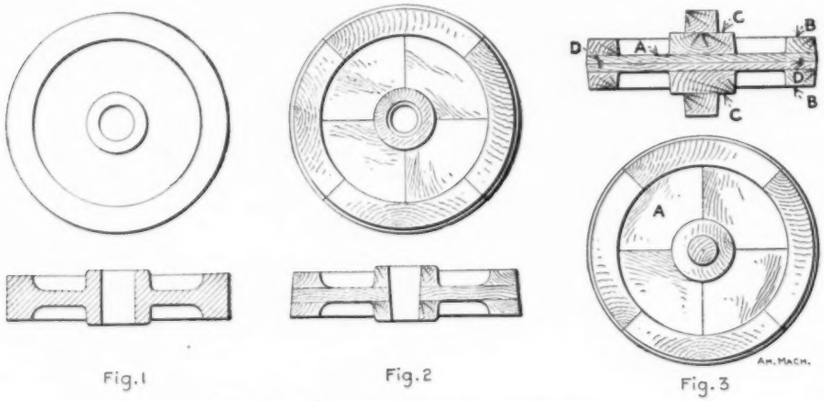
Agricultural machinery contains considerable gray iron which forms excellent scrap for the emergency cupola. Any scrap that will break readily under the hammer and show a gray fracture and file easily is suitable for the emergency cupola. If the metal has been galvanized or tinned it is just as good for the cupola, as the zinc used in the galvanized process will be vaporized and driven off and the tin will be partly driven off and partly alloyed with the iron. Tin does not injure iron, but, if anything, renders it slightly more fluid.

When castings with a hard or chilled face are required, it is necessary to use a chilling iron and to cast the metal against an iron chill; in other words, a portion of the mold must be made of iron. These chills can be made of ordinary gray iron and should be at least three inches thick. For a chilling mixture car-wheel scrap or chilled-die scrap should be taken.

There is considerable scrap around a mine in these days which is composed of special alloy metal, as, for instance, manganese or chrome steel and other similar hard alloys. These cannot be melted successfully in the emergency cupola.

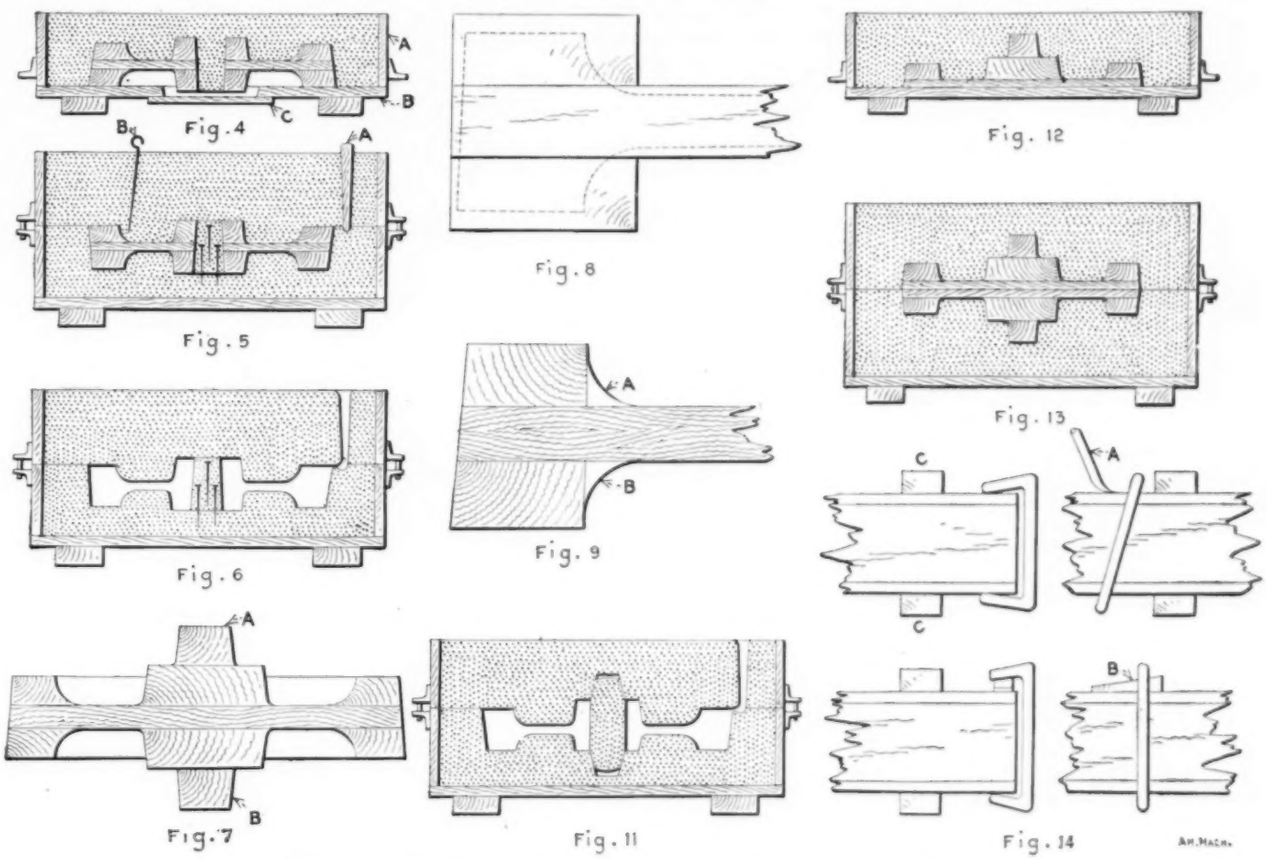
Making Chilled Castings

Where reference has been made to car wheels in this article, the standard chilled-face cast-iron railroad-car wheel is the one in mind. There are now on the market steel car wheels the material of which cannot be successfully melted in the small cupola, and many of the small mine-car wheels are made from nonchilling mixtures or mixtures that chill but slightly. As a rule chilled work is much harder to make than gray iron, and it is usually best to use dry-sand molds when dealing with chilled work and to warm the chills before pouring the metal into the mold. The object in warming the chill is twofold: it prevents the pres-



Wooden Patterns for a Simple Roller

ence of moisture on the face of the chill, and prevents the too sudden setting of the metal when it first strikes the chill, which would result in rough spots or folds in the iron, commonly called "cold-shuts." The chills are warmed to about 200 or 300 degrees Fahrenheit and sometimes not much above 100 or 120 degrees Fahrenheit. Where chills are used in green-sand molds without warming the chills the face of the chill should be rubbed over lightly with ordinary machine oil and as much as possible of the oil rubbed off with a piece of waste. This thin film of oil prevents moisture condensing on the face of the chill. In no case should the chill be colder than the body of sand which composes the mold. Care should also be taken to see that the face of the chill is not rusty, for rust would cause the metal to blow and ruin the casting.



MOLDING ROLLERS FROM PATTERNS WITHOUT AND WITH CORE PRINTS

POURING THE MOLDS

After the metal has been tapped from the furnace into the ladle, more or less slag will rise to the surface and this should be skimmed off before pouring or should be held back from the lip of the ladle with a skimmer made of a piece of steel rod. Sometimes the slag which rises to the surface is not easily skimmed back, and in such a case a small handful of dry sand may be thrown over the surface of the metal and this will bind the slag together and make it possible to skim it easily. As already stated, the metal should be covered with powdered charcoal if it is to be kept in the ladle any length of time, but for ordinary small work and for ladles up to a couple of hundred pounds it is not necessary.

When pouring the mold the metal should be poured in a steady stream and at such a rate as to keep the sprue full so as to prevent the washing of slag or other impurities down the sprue. Those who are not accustomed to pouring will generally succeed better with the double-shank ladle than with the single-shank or hand ladle. The castings should be left in the sand until the metal is thoroughly set and they will be softer if left in the sand until cool. This, however, has a tendency to burn the sand pile thoroughly, so that some foundrymen prefer to shake them out while redhot.

Where wooden flasks and particularly flasks having bars to help support the sand, are used, it is well to take off the flasks soon after the metal is set, but to leave the casting buried in the sand until it has cooled or at least become black.

CRUCIBLE MELTING

As has already been stated, iron may be melted in a crucible. This method, however, is usually employed for melting brass or bronze. The crucible consists simply of a sheet-metal shell which is lined with firebrick or a mixture of fireclay and sand. The grate consists of a number of iron bars passed through holes in the front and back walls of the shell. Underneath this is a space five or six inches in hight from which the ashes may be raked out through an opening at the front. This opening is ordinarily closed with some kind of a door and the blast of two or three ounces introduced under the grate through a pipe shown at the back. The fuel generally used is coke, though either charcoal or anthracite coal may be employed. The crucible is placed on a bed of coke surrounded by fuel. The top of the furnace when in use is partially covered with cast-iron plates or fireclay slabs.

Sometimes instead of using forced draft under the grate the products of combustion are taken out through an opening near the top of the shell and this opening is connected with a high stack, the natural draft being depended upon to cause rapid combustion. Graphite crucibles are used and when the metal is melted they are lifted out by special tongs and then handled in either single or double shanks.

There is a great variety of patterns for making iron castings which require some form of cored work. Such castings have

openings or holes in them which it is difficult to form with the same body of sand from which the mold is formed. In some cases cores are formed from the molding sand, as will be shown herein, but generally where a fairly thick casting is penetrated by a hole it is best to make the core as a separate body of sand and set it into the mold.

Fig. 1 illustrates a simple roller 12 inches diameter, and with a 2½-inch face. This has to be bored through the center, finished on both sides of the hub and turned on the outer face. The surfaces to be finished are marked with a small letter *f*. Where finish is required the patternmaker usually adds ⅛ inch of metal.

Draft of Patterns

The allowance for drawing the pattern from the sand is called "draft" and is usually $\frac{1}{16}$ inch per foot. The pattern for the casting shown in Fig. 1 may be made in several ways. A solid pattern may be made and arranged to leave a green-sand core for the hub, or a solid pattern with core prints and a dry-sand core for the hub, or a split pattern may be used. Each one of these will be illustrated and their relative advantages discussed.

The solid pattern constructed for leaving the green-sand core is shown in Fig. 2; the dimensions show the allowances made. It will be noticed that the pattern is 12⅛ inches diameter at the small end; ⅛-inch allowance has been made for shrinkage as the metal will shrink ⅛ inch per foot and ⅛ inch has been allowed on each face for finish. The large end of the pattern is made 12½ inches, the extra ⅛ inch being for draft. As the diameter of this piece is fairly large, $\frac{1}{16}$ inch on the side would give sufficient draft. The hub is bored hollow, as shown, being a taper of ¼ or ⅛ inch on the side, it being necessary to allow more draft in a case of this kind where the sand would have a tendency to stick to the pattern and be broken away from the mold and lifted with the pattern.

Method of Molding

The method of molding used with a solid pattern is illustrated in Fig. 4. The pattern is placed on the bottom board *B*, and the drag half of the flask *A* placed about it. Sand is then riddled or sifted on the face of the pattern to the depth of ½ inch and the mold filled with sifted sand. The core inside of the hub should be carefully tucked and the rest of the sand rammed.

Care should be taken to peen the sand well around the edges of the flask, but at the same time the mold should not be rammed as hard as possible, since too hard ramming packs the sand so tightly that the gases cannot escape, and as a consequence the gases from the mold would be forced into the metal, resulting in a spoiled casting. The foundryman would call this blowing, and the holes formed by the gases "blow-holes."

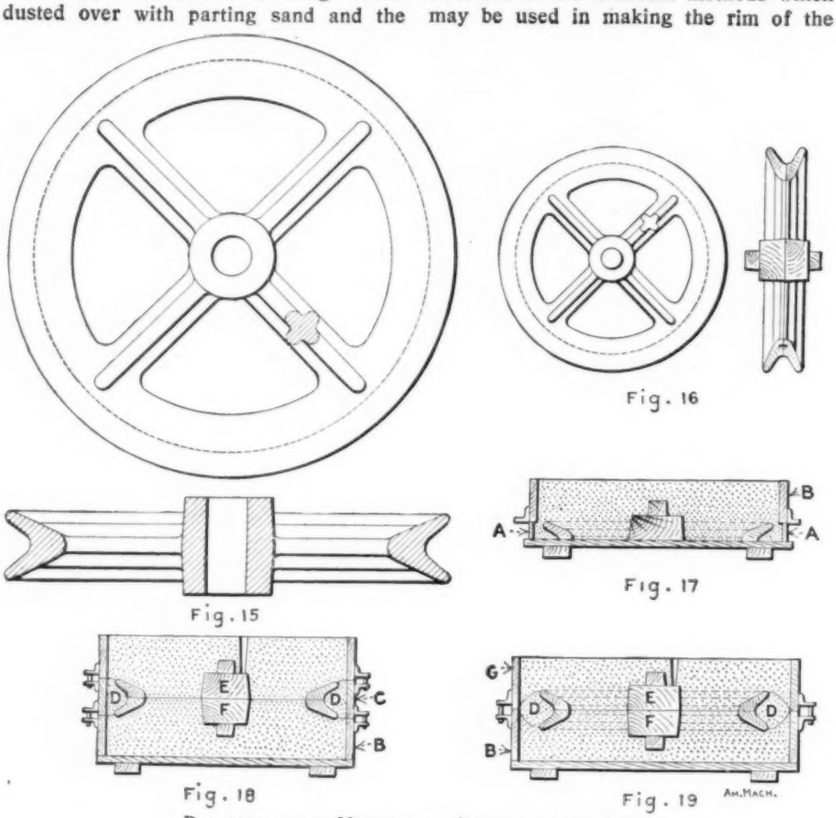
Owing to the fact that the hub in this case projects beyond the face of the rim it is necessary to cut out the center of the bottom board as shown at *C*, and to tack a piece on the under side of it to support the sand in the hub. After the drag has been rammed a board is put on its upper surface, clamped in place, and the whole rolled over. The molding board is removed and the sand is then struck level with the top of the hub, and two or three nails shoved down into the hub as indicated in the section shown in Fig. 5. These nails serve to hold the green-sand core together when the pattern is drawn off.

The upper surface of the drag is then dusted over with parting sand and the cope flask placed in position. The sprue pin is set as shown at *A*, and some facing sand riddled on the face of the pattern. The flask is then shoveled full of riddled sand and rammed. If the flask is more than six inches deep it is best to put about six inches of sand in the flask first, peen it and then add more sand and repeat the peening operation. The spaces in the cope which project into the hollow between the hub and the rim of the wheel must be rammed a little harder than the rest of the mold, so that it will lift freely. To prevent blowing, a vent wire should be run down into this part of the mold as indicated at *B*, making a series of holes all the way around the pattern and not more than 1½ inches apart.

After the mold has been rammed, struck off and vented, the sprue pin *A* is removed and the cope lifted off. The pattern is then rapped with a mallet to loosen it from the sand and is lifted out. The gate connecting the sprue with the mold is then cut and the cope replaced, as shown in Fig. 6. The mold is now ready for the metal. This method of molding does away with the necessity of any dry-sand cores, but the taper which must be allowed on the green-sand core necessitates an extra amount of machining work in boring the casting.

Making Patterns

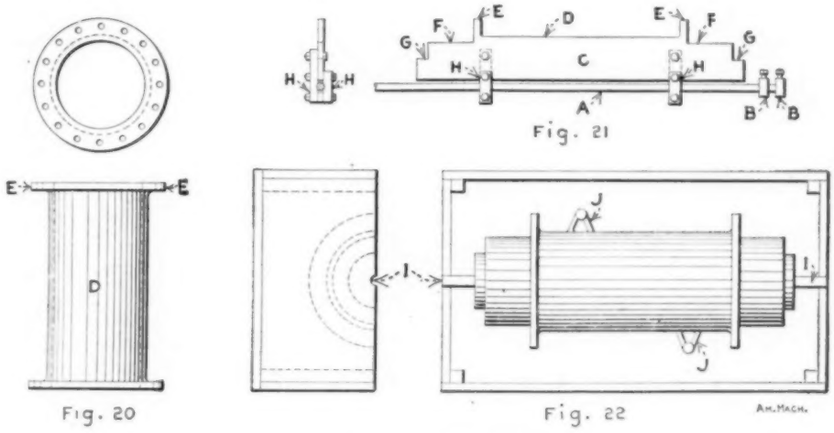
At this point it may be well to call attention to the different methods which may be used in making the rim of the solid pattern, as shown in Figs. 2 and 7. The web of the pattern may be made of one solid board if the pattern is of a temporary nature; but if it is to be kept for future use it is best to make the rim of at least four segments, so that the grain of the wood in each segment will run in approximately a radial direction. The reason for this is that lumber shrinks across the grain, but has little appreciable shrinkage in the direction of the grain. The rim may be made in segments and glued on, as shown in the upper part of Fig. 2, and in cross-section in Fig. 8. The pattern may then be turned out as indicated by the dotted lines in Fig. 8. The fillet on the inside



Patterns and Molds for Casting a Sheave

of the rim is in this case turned from solid stock.

In case no turning lathe is available the pattern may be made by sawing the segments to exact size inside and out and also tapering them and securing them to the web as indicated in Fig. 9. The fillets are then worked in with beeswax, as shown at *A* and *B*, Fig. 9. For temporary work, fillets are sometimes made of plaster of paris, or of cement, but wax is generally considered best, because it does not break out as does plaster or cement. The pattern should be given one or more coats of shellac varnish and sandpapered lightly before it is sent to the molder. The reason for this is that if the pattern is not protected it will absorb moisture from the sand, become rough, and it will be impossible to draw it from the sand satisfactorily. It is not necessary nor desirable to give patterns a piano finish, as they draw better from the sand if they are simply protected from the sand and still show sand-paper marks. An absolutely polished pattern lies to the sand so closely that it is nearly impossible for the air to find its way in as the pattern is drawn. This is only true in the case of very fine molding sands when fine work is wanted, but in no case is it necessary to have highly finished patterns, the important point being to so cover the surface as to prevent it from absorbing moisture.



EXAMPLES OF SWEEP WORK

DESIGN OF SPLIT PATTERNS

If a large number of these rollers were required it would pay to make a split pattern as shown in Fig. 3. This is the best pattern for this type of work, but it is also the most expensive. The use of a split pattern, however, simplifies the molding. The central web *A* should be made of at least four pieces butted together at the center and so arranged that the grain in each piece runs radially. To these web pieces the rim segments *B B* are glued, each half of the pattern being made up separately. The hubs are attached to the center of the webs, as shown at *C C*. The rim segments *B B* and the hubs *C C* serve to bind together the segments of the rim *A*. Each half of the pattern is turned separately, and the two are then joined by dowel pins as shown at *D D*. These dowel pins should be so spaced that it is impossible to put the pattern together in any but the right way. Where an attempt is made to place them on radial lines one of them is sometimes misplaced 1/32 inch or more, so that if the parts of the pattern are put together in the reverse position the faces will not correspond and there will be what the foundryman calls "shift at the parting." By purposely placing the pins so that if the pattern be put together in the wrong way there will be a shift of an inch or more, the error is immediately visible.

Molding with a split pattern is simplified, as no hole in the bottom board is required. The operations are shown in Figs. 12 and 13. The part of the pattern which does not contain the pins is laid on the bottom board, as shown in Fig. 12, and the drag rammed up. A board is then clamped on the top of the drag and the whole rolled over. The board on the face of the pattern is then removed and the second half of the pattern placed on the first half, the pins guiding it into its proper position. Parting sand is then sprinkled over the surface of the mold, the sprue pin set, the cope filled and rammed as shown in Fig. 13. The sprue pin is then drawn and the cope lifted off. In this case half the pattern is drawn from the cope and the other half from the drag, the depth of the draw being just half what it was in the previous case.

After the pattern is drawn the core is set just as in Fig. 11, and the mold closed, when it is ready for pouring. When rolling a flask over, it is necessary to clamp a board to the bottom of the flask. This may be done with an ordinary U-clamp, as shown in Fig. 14. At the top of the illustration the clamp is shown secured by cramping over. The pinch bar *A* is used to crowd one end of the clamp to one side, so that the clamp takes a diagonal position as shown; this action tightens it to the bottom board.

In some cases wedging has to be resorted to. This is illustrated in the lower part of the figure, the wedge *B* being forced under one end of the clamp. Where wedges are used, however, the hight of the clamp above the bottom board is increased and it is sometimes necessary to roll over a block or board in order to prevent the clamps from striking the floor. The battens on the bottom boards, as shown at *C C*, should be of sufficient thickness so that when the mold is rolled over the clamps do not strike the floor.

MAKING THREE-PART MOLDS

Frequently castings are of such a form that it is necessary to resort to three-part molds or molds containing more than three parts. A good example of this type of castings is the small sheave wheel shown in Fig. 15. Guide wheels of this kind are used in slopes and for supporting ropes in horizontal drifts. A pattern of this kind must be of the split-pattern type, as otherwise it would be impossible to remove the pattern from the mold without disturbing the sand in the groove. It is possible to cast a sheave in a two-part mold by forming the groove with cores and in this case the pattern is made with the core print extended clear around the outer edge and a suitable core box made to produce a core equal to about one-sixth or less of the circumstance of the sheave.

When making the sheave entirely in green sand, the pattern shown in Fig. 16 must be constructed. This is built of segments and turned or worked out to the desired form. In molding, the half of the sheave which carries the pin holes is placed on the molding board as shown in Fig. 17. A narrow frame equal to about half the width of the sheave is placed in position around the edge as shown at *A A*, and the drag flask placed on top, as shown at *B*. The drag is rammed in the usual manner, the bottom board clamped in place, and the whole rolled over. The molding board and frame *A A* are removed and a parting formed from the edge of the sheave to the edge of the drag. An intermediate part, as it is called, is then placed on the drag *B*, as shown at *C*, Fig. 18. The second half of the pattern is placed in position, parting sand sprinkled over the face of the parting, and the body of sand *D D*, rammed into the groove about the pattern. A second parting is formed opposite the upper edge of the rim and the drag flask placed in position. Parting sand is then sprinkled over all the sand faces exposed, a sprue pin set on

the hub of the pattern, and the cope portion of the mold rammed and struck off as shown. To remove the pattern the cope is lifted off and the upper half of the pattern *E* withdrawn. The practice from this point on varies.

In some cases the intermediate part *C* is next lifted off and the second half of the pattern drawn, after which the intermediate part is returned, the hub core set and the cope closed in position, ready for pouring. In other cases, after drawing the first half of the pattern *E*, the cope is closed on the mold once more, the bottom board placed in position, the mold rolled over and the drag *B* lifted off. The other half of the pattern *F* is then drawn, the hub core set, the drag returned and the mold rolled back into position ready for pouring. The reason for this latter method is that the narrow body of sand in the intermediate part *C* is difficult to lift without its falling.

When a three-part flask like that shown in Fig. 18 is not available, the three-part mold is sometimes made in a two-part flask, as shown in Fig. 19. To accomplish this, the drag half of the pattern *F* is first placed on the mold and the drag rammed. The drag is then rolled over and the sand around the edges of the flask cleaned out so as to form an inclined surface terminating at the edge of the lower flange. The cope half of the pattern *E* is then placed in position, parting sand sprinkled over the face of the mold, and a body of sand *D D* rammed or tucked in around the outer edge of the sheave so as to fill the groove. The upper face is smoothed and parting sand sprinkled over it, after which the cope flask *G* is placed in position, filled with sand and rammed.

To remove the pattern from the mold in this case only one procedure is possible, and that is as follows; The cope is lifted off and the cope half of the pattern *E* is drawn. The cope is then returned to the mold and the mold rolled over. This leaves the body of sand *D* resting on the cope so that when the drag flask *B* which is now uppermost is lifted off, the portion of the pattern *F* may be withdrawn. After drawing the half of the pattern *F* the drag is returned to place and the mold rolled back so as to bring the cope uppermost. The cope is then lifted off, the core for the hub placed in position, the cope closed into place, and the mold is ready for pouring. The core for the hub for this pattern may be made in the half-core box, such as has been shown in one of the previous articles. There is a large variety of irregular castings which require three- or four-part molds, but the principles involved are the same as those shown, and each case can easily be worked out from the general principles set forth in this article.

Hints in Connection with Foundry Work

Before closing a mold be sure that there is a sprue hole through the cope and the gate cut from the bottom of the sprue to the mold cavity, so that the metal can enter the mold freely.

Before starting to ram the cope part of a mold be sure that parting sand has been sprinkled over all of the exposed faces of the drag.

Before shoveling sand into the cope be sure that the sprue pin has been set in place.

Before rolling the mold over be sure that the molding boards are clamped firmly in place.

Before pouring a mold see that it is set level and firm on the floor and that the cope is weighted down or firmly clamped to the drag.

If in molding it becomes necessary to carry sand in fairly deep pockets, hooked-shaped pieces of iron wire made of rod iron, called by the foundryman "gaggers," may be used. These are bent into the form of hooks, dipped in clay wash and placed in the sand as the molds are being rammed.

In making a pattern the difficulty of calculating shrink may be avoided by using a shrink rule. A shrink rule for gray iron is made by taking a strip of wood or metal 12⅛ inches long, dividing it into 12 equal parts, and calling each 1 inch, subdividing these into eighths or sixteenths as the case may require. Shrink rules may be obtained from any of the standard foundry-supply houses and by using them in the construction of patterns, mistakes are avoided.

Shellac is the best varnish for finishing patterns. It may be purchased or made, but it is better to cut one's own shellac, buying the standard yellow shellac and cutting it either in grain or wood alcohol. A mixture of wood and grain alcohol will not work well, and many forms of denatured alcohol will not work well, as these blends interfere with the shellac in some way, making a muddy varnish which does not give a good finish.

Casting without Complete Patterns

To produce a casting it is necessary to have an impression in the sand corresponding to its form. This impression may be made by means of a solid pattern, as already described, or by cutting the opening in the sand with suitable strikes or tools. This is called sweep work. All sweeps must be guided in some manner either from a straight-edge and a curved guide, or a spindle. One of the simple examples of sweep work is the making of a short flange pipe-section such as is shown in Fig. 20. In this case the pipe is 3 feet long and 16 inches diameter. The bolt holes in the flanges are drilled after the casting is made.

The making of a casting of this kind by the method to be described necessitates the use of a strong, rigid flask capable of supporting the sweep. The sweep is made as shown in Fig. 21, and consists of an iron shaft *A* which may be of any convenient diameter or may even be made of a piece of gas pipe about 2 inches in diameter. To one end of the shaft are fitted two collars *B B*, the space between the collars being equal to the thickness of one end of the flask.

The sweep proper is a board *C* which is cut so that its outer edge has the form of the pipe and core print. The edge *D* forms the impression for the outer surface of the pipe as shown at *D*, Fig. 20. The projections *E E* cut the impressions for the flanges *E E*, Fig. 20, while the portions of the sweep *F F* cut the impressions for the core print to support the core for forming the inside of the pipe. The projections G G are placed on the sweep simply to form additional clearance at the ends of the prints to aid in taking off the vent from the core. The sweep is clamped to the spindle *A* by means of two clamps *H H*. For use the sweep is laid across the top of the flask which is shown in Fig. 22, the spindle *A* resting in the notches *I I*. The two collars *B B* fit over one end of the flask and hold the sweep in place. Sand is then rammed into the mold and the form of the pipe swept out by rotating the sweep. The halves of the flask must be perfectly level on top and when the upper surface is reached the sand is struck level.

The cope and drag portions of the flask are made separately, each having a perfectly level parting, and they are then assembled, taking care to bring impressions left by the spindle into perfect alinement and to aline the flasks at the end which was used as a guide for the spindle. For pouring a casting of this kind, two gates will be of advantage as indicated at *J J*. Of course, in the case of the cope it will be necessary to have bars in the flask to help support the sand and also to have a bottom board clamped firmly on while the cope is being rammed and struck. After the cope is rolled over and assembled on the mold the board upon which it is rammed is removed.

The down gates or sprues which come opposite the runways *J J* may be formed by means of pins or gate sticks during the ramming of the mold or they may be punched through the sand afterward by means of a piece of pipe; it is better, however, to form them with a sprue stick or pin during the ramming.

German employers, without an exception, claim that compensation insurance pays from a business standpoint as well as from a welfare standpoint; that it makes for an efficient nation.

Scale Beam Tools and Machines

By Ethan Viall

Shop practice of the Canadian branch of an American firm.

Novel grinding jigs and machines.

A special double-end graduating machine here described for the first time.

Marking and notching.

The Canadian branch of the E. & T. Fairbanks Company, Sherbrooke, Quebec, is a model plant in many ways. Scales of all kinds for the Canadian trade, are made here, from the small grocers' scales to the huge platform and grain-weighing scales, and the tools and machines used for finishing scale beams of all types and sizes are of considerable interest.

Some of the beams are shown in Fig. 1 and illustrate a few of the many different kinds made. The two upper ones have been graduated and numbered, but not drilled, while the others are just as they come from the grinding machines.

The double beams are generally ground straight on the sides, while many of the single beams are slightly beveled, though no rule can be given, as the beams are used on scales made for every conceivable purpose and beside the regular line, many are specially designed.

Jigs and Grinding Machines

Fig. 2 shows the jigs used to hold the beams while grinding the sides. The bodies of the jigs are made of wood for lightness and have thin-steel plates screwed to the sides to prevent wear. Adjustment for grinding the beam either flat or bevel on the sides, is obtained by means of the levers *A*, which tilt the jig. Clamping is done either by thumb screws as at *B* or with a spring-clamping device, as shown at *C* and *D*. This latter device is operated by a flat spring engaging notches in an upright post as shown at *C*, the spring operating a pin connected with toggle clamps in such a way that pressing down on the spring closes the clamps in toward the sides of the jig, and raising the spring loosens them, each jig being made to hold a beam on each side, so that one will do for grinding both sides of a beam, though only one beam is clamped into a jig at a time.

In using a jig, a beam is clamped in it, the pads *E* and *F* sliding on the rail next to the grinding wheel and the tilting lever sliding along the outer rail, as shown in Fig. 3. The work is held against the grinding wheel by the roller *A*, mounted on a lever *B*, which is operated by a strap connected to foot lever *C*.

The grinding wheels used on this machine are made of wood faced with carborundum, and give surprisingly efficient results, far better it is claimed, on these brass beams than any other type of wheel.

The wheels are well hooded on all the machines and in order to easily change wheels, a section *D* of the frame, is hinged so it may be dropped down and the hoods are removed by loosening two thumb nuts which release the iron clamps binding them to the frame.

Beam Graduating Machine

The beams are graduated on the double-end, specially built machine shown in Fig. 4. The mechanism of the two ends is identical except that the left-hand end is made to take considerably longer beams. The drive is individual for each machine and in fact they are two separate machines mounted on one bed, as can be seen by inspecting the cut.

Fig. 5 shows the feeding mechanism for both the table and cutting tool, as viewed from the back and end.

The carriage *A* is moved along by the ½-inch pitch lead screw *B*, which is given its intermittent motion in order to space for the graduations on the scale beam, by means of the index box *C*, operated by means of the connecting rod *D* fastened to the crank disk *E* geared to the drive pulley *F* at *G*.

The index box *C* will be described in detail further along in this article, but at present suffice it to say that the action is that of a pawl on a ratchet. This feeding mechanism is only made to feed the table forward when graduating, and in order to run the table back rapidly, the gear *H* is placed on the lead screw and runs continually, being meshed with the gear on the drive pulley *F*, and the clutch for the table reverse is thrown in either by means of the hand lever *I*, or by a stop against which the table feeds. As the table runs back, it strikes the stop *J*, throwing out the clutch, leaving the table in position to feed forward again.

Operating the Tool Slide

Attention should be directed, while studying this halftone, to the method of operating the tool slide *K*. The shaft *L* carries the bevel gear *M* on the end, meshing with another bevel gear on a cross shaft which runs through the bed under the table, and the action of which will be shown in the next halftone. The bevel gear *M* has a crank pin in its face which operates the connecting rod *N* and rocks the bell crank *O* and through it moves the slide *P*, which gives the tool slide *K* and tool *R* the cutting motion.

The bevel gear on the cross shaft also has a crank pin in the face, to which the rod *S* is connected, and rocks the index

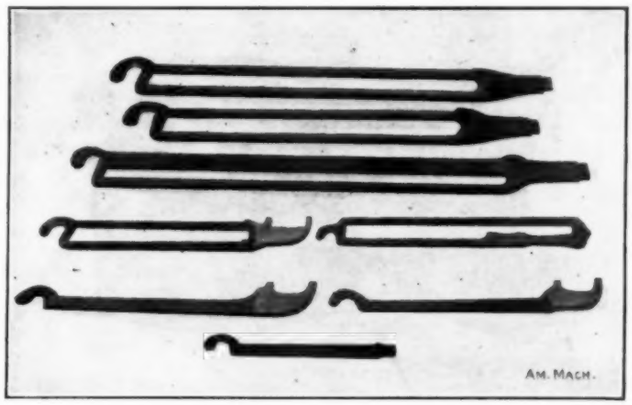


Fig. 1. A Few of the Different Types of Scale Beams

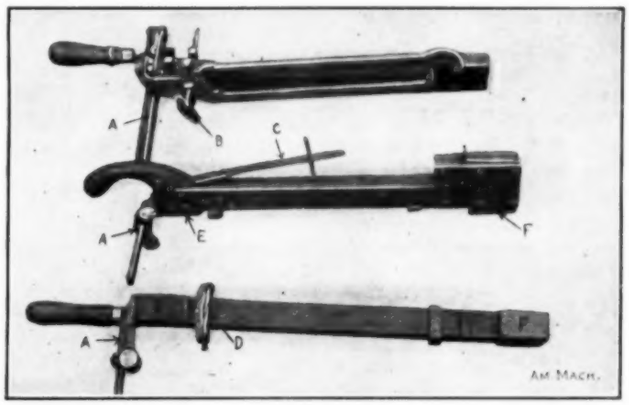


Fig. 2. Adjustable Beam-polishing Jigs.

box *T*, which is made on practically the same plan as the index box on the feed-screw mechanism, and as the box rocks the pawl turns the ratchet disk and revolves the spacing block *U* in the face of which pins are set to vary the length of the stroke of the cutting tool. Spring *V* engages another ratchet and prevents the block from reversing. Springs *W W W* at each end and the middle of the slides prevent lost motion and keep them in the proper position.

The clutch *X* on the shaft is used to throw out the tool-operating mechanism and is operated by the levers *Y* and trip *Z*.

Before going further into the details of the feeding and tool-stroke operation, we will pass to Fig. 6 and see how the apparatus is worked from the front.

Holding Tool and Regulating Depth of Cut

The scale beam is clamped to the table with small clamps as shown, and if the graduations on the two bars of the beam are the same, two tools are used, but if the graduations are of different length or spaced differently only one tool can be used, as in this case. The graduating tool is ground on the end about like a thread tool and is clamped to the beam as shown at *A*. A guard *B* is used to regulate the depth of the cut and prevent the tool cutting too deep.

Raising Tool on Return Stroke

At *C* is an eccentric on the end of the cross shaft previously referred to, and this eccentric is so timed that the rise is uppermost when the tool slide reverses, so that the tool will clear the work and not drag as it travels back, and also so the table and beam may be moved along the correct distance. The action of this eccentric will be clear to the reader when it is explained that the tool slide is hinged at *D* and is pulled upward and back by the spring *E*, assisted by spring *F*, the connecting rod *G* merely serving to pull the tool slide down as the eccentric turns, the spring arrangement where the rod *G* is fastened to the eccentric strap allowing a certain amount of flexibility.

Leveling the Beams

At *H* and *I* are two eccentric table-leveling devices used to set the table according to the beam being graduated, as some of the beams are gradually thinned toward the outer end.

J is the slide to which the feed stops are clamped in order to reverse the table feed or throw out the reverse clutch, as desired.

Details of the Index Box

Referring now to Fig. 7, which shows an enlarged view of the feed-screw index box, we will get a clear idea of the way the table is made to feed along in order to give the correct spaces between the lines graduated on the scale beam.

This index box contains four index or ratchet disks, any one of which may be used by shifting the pawl *A* and spring *B*. The pawl is easily shifted by removing the screw *C* and changing the position

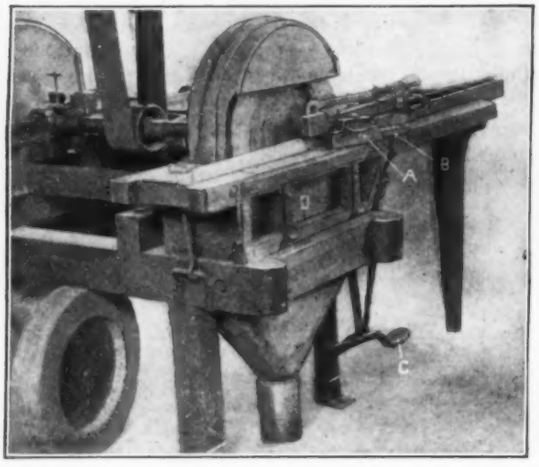


Fig. 3. Beam-grinding Machine

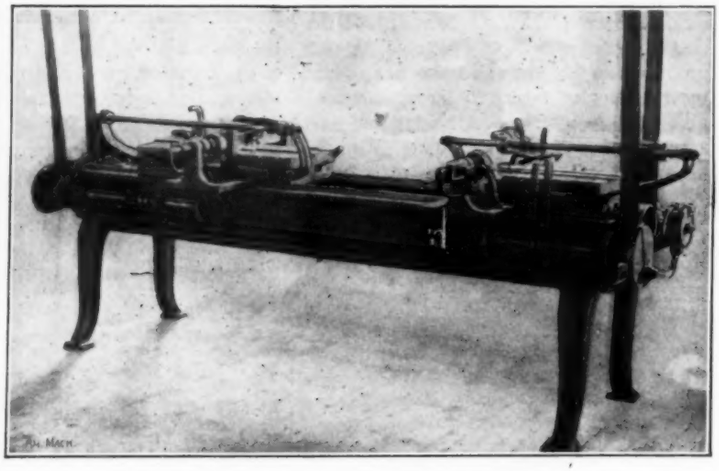


Fig. 4. Double-end Beam-graduating Machine

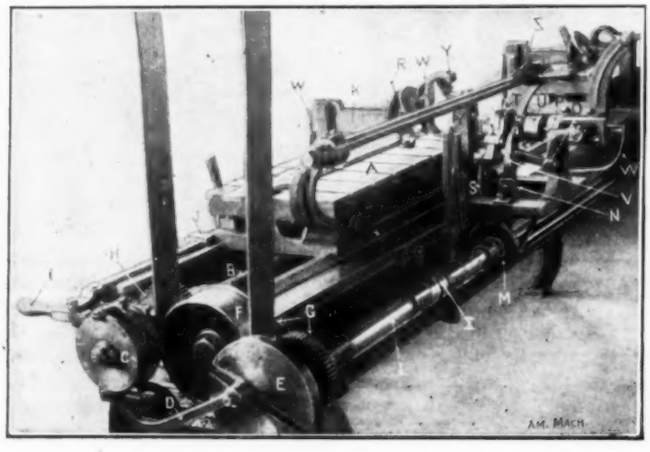


Fig. 5. Feeding Mechanism from the Back

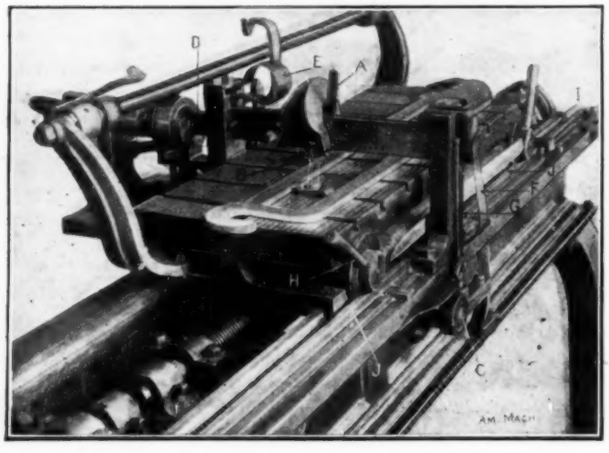


Fig. 6. Tool-operating Device from the Front

of the collars *D*, *E* and *F*, while the spring is shifted by means of the screw *G*.

Now, the first ratchet disk has 12 teeth, the second 10, the third 9 and the fourth 8, and as the lead screw is ½-inch pitch, suppose it is wanted to graduate a beam 24 divisions to the inch, then the 12-tooth disk would be used for feeding and so on, the connecting rod *H*, of course, being set in the slot of the crank disk *I* in the correct position to give the right stroke in each case.

Extra index boxes, containing ratchet disks with teeth to give every division necessary for any practical graduation, are kept on hand and are easily substituted for the one shown.

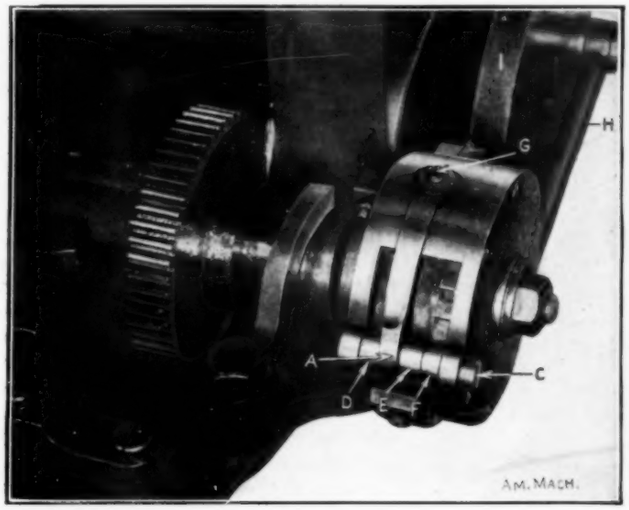


FIG. 7. LEAD SCREW INDEX DEVICE

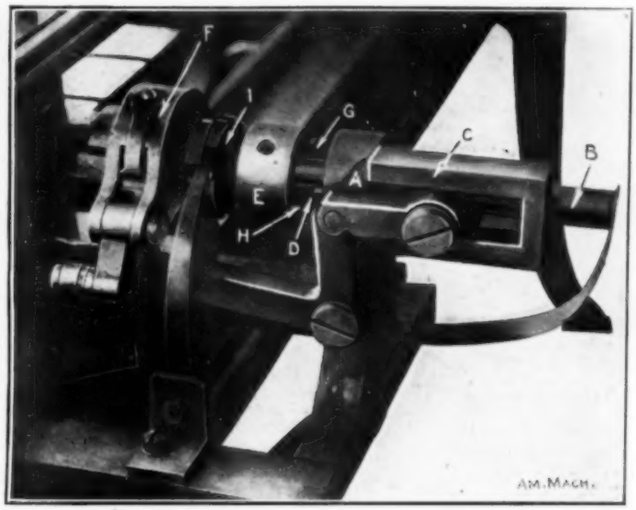


FIG. 8. VARIABLE-STROKE MECHANISM

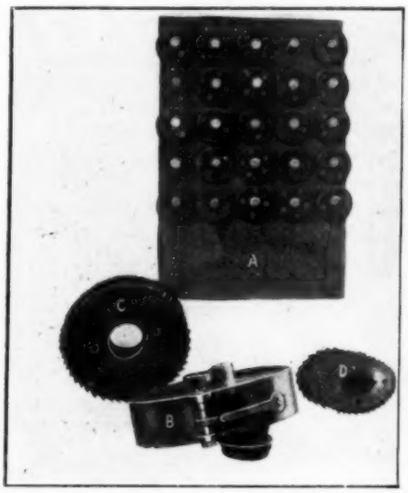


FIG. 9. VARIABLE-STROKE AND INDEXING DISKS

FIG. 10. STAMPING IN NUMBERS AND OTHER MARKS

DETAILS OF THE VARIABLE-STROKE MECHANISM

Next, referring to Fig. 8, which shows the tool-slide operating mechanism enlarged, we will note that the slide *A*, which gives the tool slide its stroke, and which slides over *B*, being guided by bracket *C*, carries a pin *D* on the face, which, as the slide moves, strikes the block *E* and moves, through it, the tool slide carrying the cutting tool.

Now, the graduations on a scale beam are not all the same length, some being graduated with four short and one long mark; others having two short, one medium, two short and a long one, and so on, and in order to vary the length of the cutting stroke of the tool, the block *E* has pins set in its face according to the length of the lines to be cut in the scale beam, and then this block is revolved as the slide *A* moves, so that the pin *D* will strike the pins or between them, according to the way the block is indexed, the indexing being done by means of the index box *F*, which carries two ratchet disks and may be changed to suit the work in hand.

In the case under consideration the block *E* has two pins set opposite each other at *G* and *H*, and a 10-tooth ratchet is being used in the index block, also a 10-tooth ratchet disk is set at *I*, in order to give the proper backing, and prevent a retrograde movement as the pawl on the index box draws back.

As the slide *A* moves and the block *E* revolves, the pin *D* strikes one of the pins in the face of block *E* every fifth stroke, making four short and one long graduations on the beam.

At *A*, Fig. 9, are a number of spacing blocks for different arrangements of the length of the graduated lines, while at *B* is an extra index box for the lead screw. Extra disks for the lead screw and graduating index boxes are shown at *C* and *D*, respectively.

MARKING THE BEAMS

The numbers, stars, crosses and other marks stamped on the beams to correctly divide the graduations so as to be easily read, are stamped in by hand, as a machine that would meet the varying requirements would be more bother than it was worth.

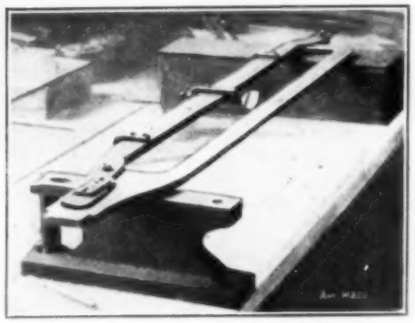
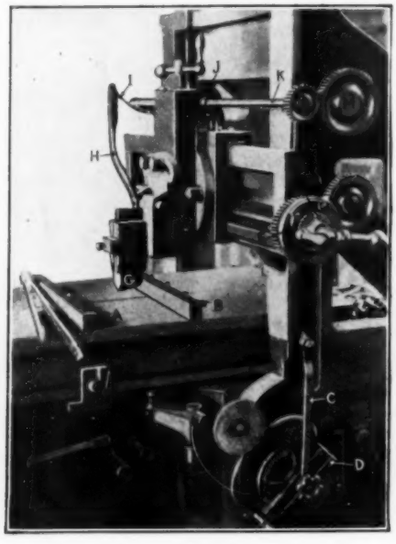


FIG. 11. SCALE BEAM DRILLING TEMPLET

While stamping the marks on the scale beam, the beam is held on a stand

by means of clamps operated by a foot lever, as shown in Fig. 10, the numbers and other stamps being held conveniently in a wooden block, fastened to the back of the stand.

Drilling templets, similar to the one shown in Fig. 11, are used while drilling the various holes in the beams.



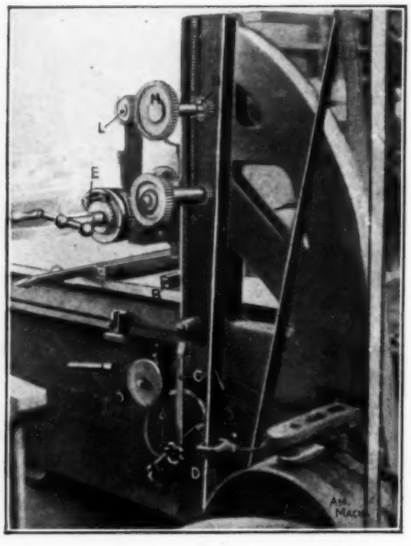


FIG. 12 TWO VIEWS OF PLANER FITTED FOR NOTCHING FIG. 13

NOTCHING BEAMS

Only a small percentage of the beams used nowadays are notched, as sliding weights are used almost universally; however, the Whitcomb planer shown in Figs. 12 and 13 was fitted up a number of years ago to notch the tops of scale beams according to the graduations.

On this planer a number of beams were notched at once, the beams being clamped between the strips *A* and *B* on the planer table. Various feeds can be obtained by adjusting the rod *C* on the crank disk *D*, which caused the pawl *E* to engage different numbers of teeth on ratchet *F*.

The tool *G* is made unusually heavy to prevent spring and is automatically lifted on the return stroke by the lever *H* and cord *I*, which runs over the pulley *J* on the shaft *K*, operated by the feed rack through the gears *L*, *M* and *N*.

This machine does very satisfactory work, though in the main factory of the Fairbanks company, where small scales are made, the beams are notched on a miller similar to a rack cutter.

Adjustable Dog Driver Used on the Lathe Spindle

BY C. G. HEIBY

The dog driver shown herewith has been found useful in so many ways in the tool-making department that I want to describe it for the benefit of the readers of the AMERICAN MACHINIST, and especially for some of the contributors to whom I am indebted.

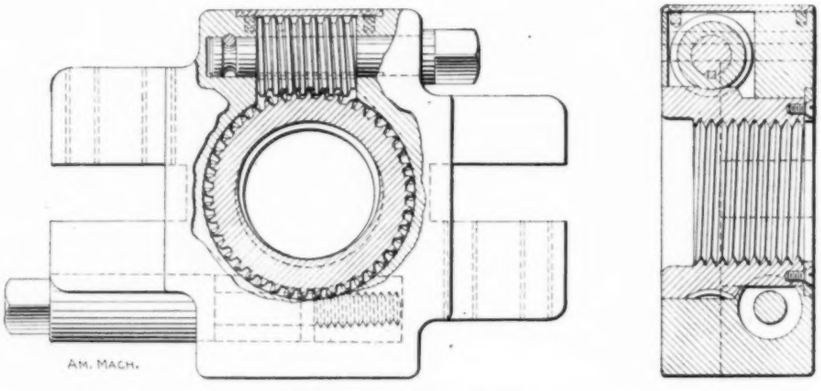
The device was originally designed with one driving member only, and was used when threading and relieving taps in the engine lathe. With this driver it was easy to set the land of the taps so that they would all come in the same relation to the cam on the relieving attachment, making it unnecessary to place the dog on the shank of the tap in any particular position, it being only necessary to revolve the tap around to the desired position by means of the worm and worm wheel.

I use it on a Hendey lathe in connection with their well known relieving attachment, and by the use of this device, it is possible to handle any kind of a tap shank without the use of special drivers and other jigs, and control the amount of relief within extremely close limits, which is necessary on taps that are required to tap perfectly round holes.

As now made, the device has two driving members, making a very handy driver for double-thread taps. The jaws being milled out very accurately and faced with hardened and ground steel plates, it is only necessary to remove the tail of the dog from one side and place it in the other and we are in position for cutting the second thread without changing the gears as usual.

A special adaptation of this driver presented itself a short time ago, which broadened its usefulness and is quite interesting. The job in question was some tapered hobs milled spiral. These hobs are used in a Bickford thread miller for cutting pipe taps, and have a series of 60-degree grooves around the periphery and it was desired to give them eccentric relief. It was first thought that it would be necessary to have a spiral cam with a follower traveling over it lengthwise, to keep the cutting edge of the hob in the same relative position to the tool for grooving it, but our relieving attachment did not lend itself to the idea, so I saw another use for the adjustable dog driver and the result was highly satisfactory. I simply fed the point of the tool into the spiral groove of the hob the same distance each time, and then rotated the hob slightly, by means of the worm and worm wheel, until the land rested on the tool, the tool was then drawn back and the groove cut and relieved as usual.

The device could be made still more useful by putting a dial with 120 divisions on the stem of the worm and then by having 45 teeth in the worm wheel, indexing could be done in degrees, one turn of the worm or dial equaling eight degrees or one space on the dial would equal four minutes.



ADJUSTABLE DOG DRIVER

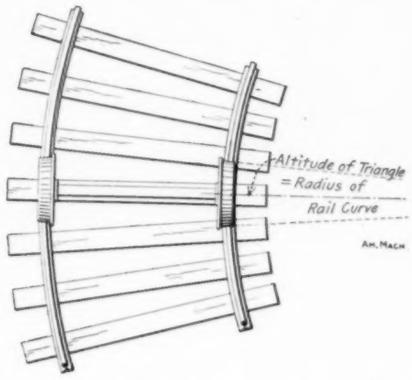
The total value of incandescent lamps manufactured, according to the recent census, increased from $3,515,000 in 1899 to $6,953,000 in 1904, and $15,715,000 in 1909. The value of the carbon filament lamps increased rapidly from 1899 to 1904, but there was a slight increase in 1909, the value for the respective years being $3,442,000, $6,308,000 and $6,157,000.

Taper for Face of Car Wheels

By R. W. J. Stewart

A flat-tread, straight-flanged wheel, in going around a curve that has a short radius, climbs out over the outside rail. It requires more energy to move a car mounted thus than is required if the wheels are properly shaped.

In building an industrial railroad the curve of least radius should be taken to get the conicality or taper for the face of the wheels. Take the radius



The Construction for Determining the Concavity

of the curve of the inside rail and the diameter of the wheel; then draw a triangle whose base is equal to the diameter of the wheel and whose altitude equals the radius of the curve. Lines taken from the extremities of the base to the curve center, forming the hypotenuse, will give the cone or taper for the face of the wheel.

A reference to the sketch will make the matter plain. By making a drawing thus to scale, and setting a bevel to the drawing and using the bevel as a guide in turning out the chill and finishing the pattern, one should be able to get wheels that would give satisfaction.

Of course, one should consider the curve of least radius, if there are others around which the car is to be moved. I would recommend a wheel with more taper than is absolutely needed. In fact, I always put a little more taper in the face than indicated. I want the flange to lean back, as it were, and to have a large fillet, the radius of which is greater than that of the corner of the top of the rail on which the wheel is to run.

The Broc Motor

The illustrations show the new "Broc" motor, the distinctive feature of which is the revolving piston which eliminates poppet valves. This should not be confused, however, with the Knight motor, as there are no sliding sleeves whatever, and the piston serves the purpose of valves.

The Broc is a four-cycle motor, in which the distribution is obtained by a piston acting as a cock, and having, in addition to the usual reciprocating motion, a continuous rotary movement. The piston consists of two parts, see Fig. 2, the interior part *D* having the usual reciprocating motion, and containing a chamber *B* with two openings. This piston is linked to the connecting rod *h* with gudgeon pin *f*. The exterior part *c*, which envelops *D* and carries the piston rings, has a port at its top, and a sinuous groove on one-half of its circumference, thus forming a passage for the inlet of the mixture arriving by *F*, and exhausting through *G* at given intervals. See Fig. 3.

A bevel gear *k* is fixed to the crank shaft, and engages another bevel gear *l* of double its size, which is solid with the tube *m* surrounding the connecting rod *h*. This tube has at its top end a fork carrying two small studs *o*, with their heads in the grooves or vertical slots *q*. These give to part *C* a continuous rotary motion, while the connecting rod gives a reciprocating motion. The two movements cause the sinuous groove, the chamber *b* and the port *a* to register with one another at the right moment, allowing the cycle of inlet through *F* and the cycle of exhaust through *G* to take place. The gearing of two to one causes the piston to travel one-quarter of a turn to every stroke of the piston, or in other words, one complete revolution for every four revolutions of the crank shaft.

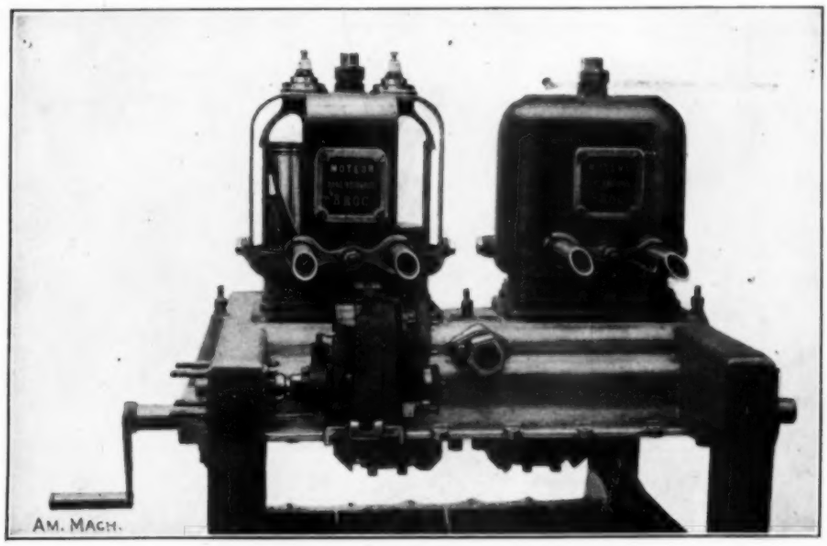


Fig. 1. The Broc Motor

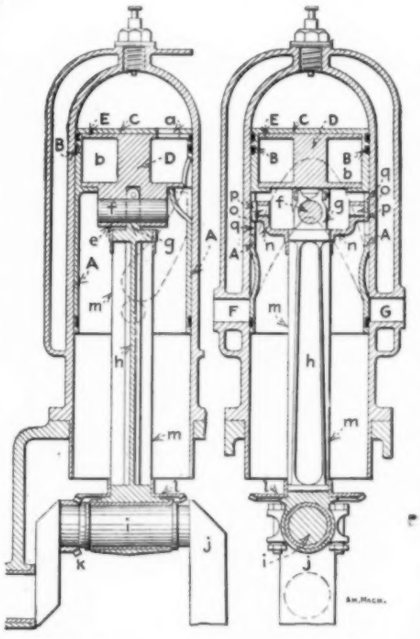


Fig. 2. Fig. 3.

Details of Construction

The engine, as shown in the illustrations, ran for 150 hours on test, and developed 34 horsepower at 1000 revolutions per minute; at 1600 the horsepower was 40. The bore is 100 millimeters (3.937 inches); stroke, 120 millimeters (4.724 inches); and the normal rating, 24 horsepower. This engine weighs 100 kilos or 220 pounds.

In air compressors where the air cylinders are directly behind the steam cylinders, running the compressor under brings the pressure of the crosshead on the lower guide; running it over brings the pressure on the upper guide, the tendency being to lift the machine from the foundation. In motor- or belt-driven compressors the light upper guide would not allow of a very heavy pull, so manufacturers usually design such machines to run under so that the pull on the connecting rod will come in a downward direction on the frame of the machine.

Horsepower of Cemented Leather Belts, by John B. Peddle

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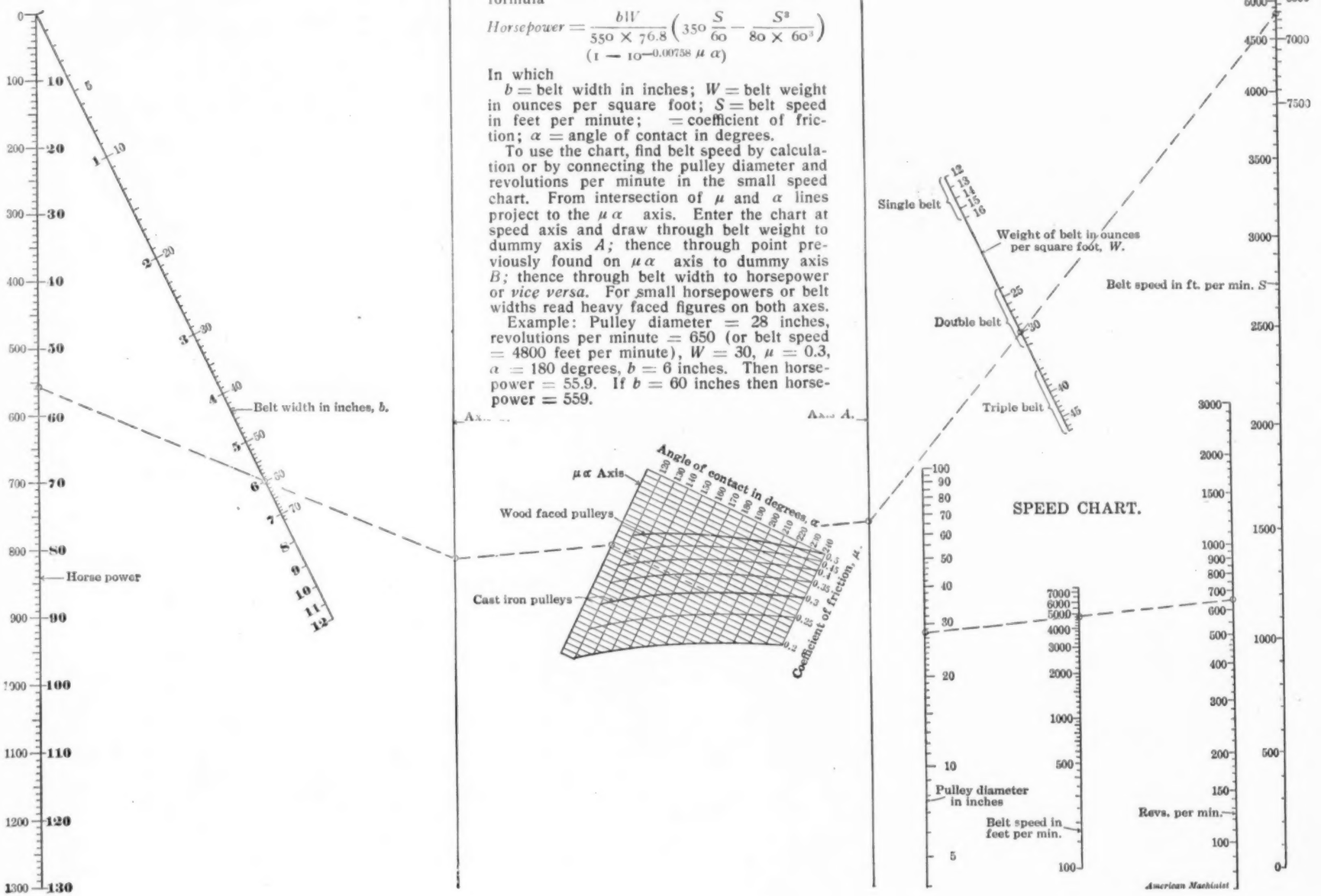
Explanation: The chart is plotted from the formula

$$Horsepower = \frac{bW}{550 \times 76.8}\left(350\frac{S}{60} - \frac{S^3}{80 \times 60^3}\right)\left(1 - 10^{-0.00758\,\mu\,\alpha}\right)$$

In which b = belt width in inches; W = belt weight in ounces per square foot; S = belt speed in feet per minute; = coefficient of friction; α = angle of contact in degrees.

To use the chart, find belt speed by calculation or by connecting the pulley diameter and revolutions per minute in the small speed chart. From intersection of μ and α lines project to the $\mu\,\alpha$ axis. Enter the chart at speed axis and draw through belt weight to dummy axis *A;* thence through point previously found on $\mu\,\alpha$ axis to dummy axis *B;* thence through belt width to horsepower or *vice versa.* For small horsepowers or belt widths read heavy faced figures on both axes.

Example: Pulley diameter = 28 inches, revolutions per minute = 650 (or belt speed = 4800 feet per minute), W = 30, μ = 0.3, α = 180 degrees, b = 6 inches. Then horsepower = 55.9. If b = 60 inches then horsepower = 559.

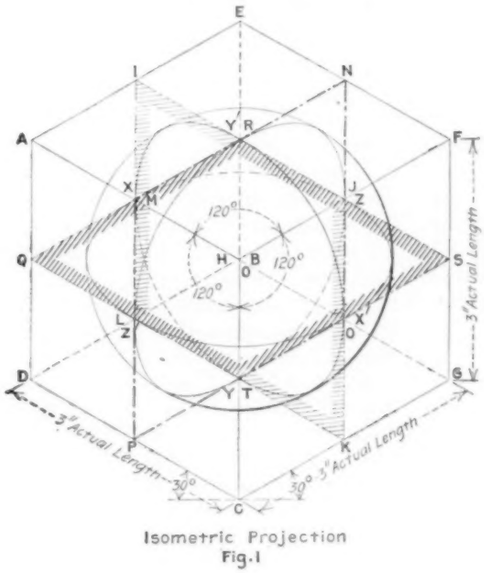


Isometric, Cabinet, Oblique Drawing

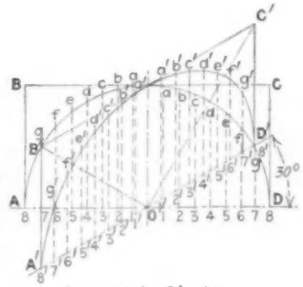
By R. B. Dale

Many drawings of this kind are made incorrectly. The figures shown serve as handy reminders of the principles so easily forgotten and thus are helpful in the production of correct drawings.

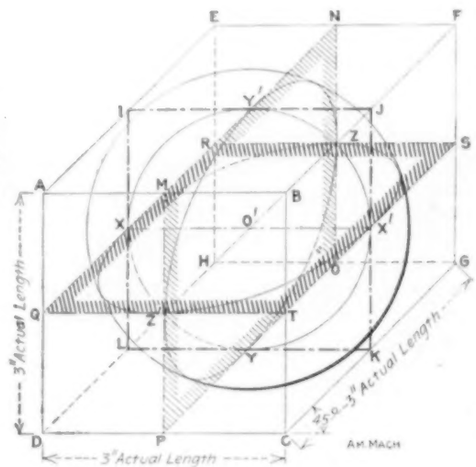
In addition to the well known and universally used methods of orthographic projection and pseudo-perspective or isometric, cabinet and oblique drawing are often of great value to the draftsman. One of these three methods is generally used when a more visual representation is desired than can be made by the usual orthographic methods. The advantages of such drawings are that they are more easily understood by those who are not familiar with third-angle projection, that they serve the purpose better for catalog and leaflet cuts and line drawings, and that they take up less space, the same scale being used in each case. Such drawings are particularly useful for piping and plumbing layouts which are to be used by the pipe fitter. Small, simple, dimensioned drawings can also be made by one of these methods, but the arrangement is most too difficult for clear reading in the case of complicated parts. While admirably useful for certain drawings, they are absolutely unfitted for the usual routine of the drafting-room work.



Isometric Projection
Fig. 1



Isometric Circle
Fig. 2



Cabinet Projection
Fig. 3

ISOMETRIC PROJECTION AND CIRCLE, AND CABINET PROJECTION

These methods are fairly well understood by every draftsman. Moreover, careful explanations are to be found in any good text book on mechanical drawing. Notwithstanding this, many mistakes are made, and badly distorted and incorrect drawings of this sort are to be found. It has been my experience that I used these methods so infrequently that the principles were easily forgotten from one time to the next. It was to serve as a handy reminder that the figures here shown were devised. They are drawn out on a single sheet and this is kept where it will be readily available for reference at any time. This sheet also serves a useful purpose in the instruction of the inexperienced draftsman The beginner is given a blueprint of these figures together with a few spoken words of explanation. It is found that the principles are readily grasped in this manner and that, after a few attempts, representable drawings are made without a careful study of a text book.

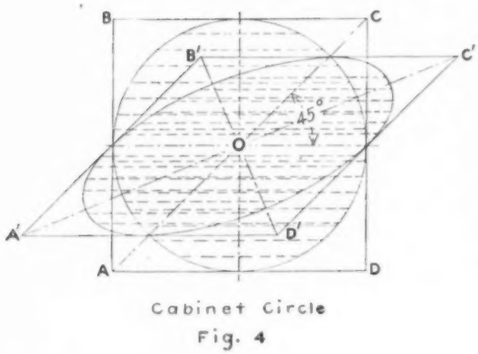
ISOMETRIC PROJECTION

While it is not intended to give a complete exposition of each of these methods, a few words in explanation of the figures may not be out of place. Fig. 1 represents a cube each of whose edges measures three inches in length, drawn in isometric projection. It is well to remember the distinction between "isometric projection" and "isometric drawing." If this cube is so placed with reference to a plane of projection that the diagonal BH is perpendicular to the plane, the true projection of the cube will have a shape exactly similar to that here shown but the projections of the edges will be shorter than their true length because these lines are oblique to the plane. Isometric drawing is, then, a practical modification of isometric projection in which all straight lines parallel to the edges of the cube as here shown or, in other words, all isometric lines are measured and drawn in their true length. In ordinary language, however, the terms "isometric projection" and "isometric drawing" are used interchangeably because it is difficult to find a word that names the resulting representation so nicely as the word "projection."

It is now plain that the figure $A\,B\,C\,D\,E\,F\,G$ is the projection of a cube whose diagonal $B\,H$ is perpendicular to the plane of projection and the edges of which are shown in their actual length. Referring to the figure, this transparent cube is cut by three median planes, the two vertical planes being $I\,J\,K\,L$ and $M\,N\,O\,P$, and the horizontal being $Q\,R\,S\,T$. These planes intersect in the lines $X\,X'$, $Y\,Y'$ and $Z\,Z'$ which intersect each other in the point O'. In each of these planes is drawn the isometric projection of the inscribed circle which is seen to be an ellipse with the major and minor axes coinciding with the diagonals of the inclosing squares. The shaded circle is the isometric projection of the sphere, three inches in diameter, which is inclosed by the cube and whose surface is tangent to the plane faces of the cube at the extremities of the X, Y and Z axes. It will be seen that the radius of this

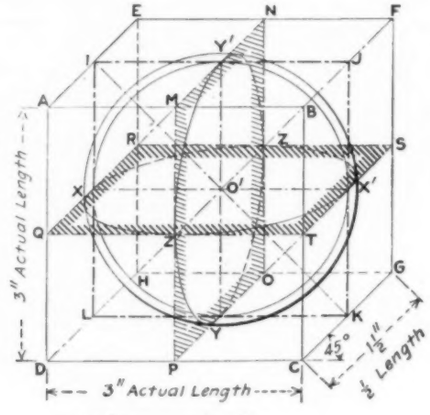
circle is longer than the true radius of the sphere by about 1.23 times that of the sphere. The reason for this will be seen when it is remembered that the ellipses are isometric representations of great circles of the sphere and therefore the projection must be tangent to these ellipses at the extremities of their major axes. The projection of the sphere is a true circle, because the projection of any sphere upon any plane is a true circle. With these facts in mind, the following rule may be used to draw the isometric projection of any sphere; with the isometric projection of the center of the sphere as a center and with a radius equal to 1.23 times the true radius of the sphere, scribe a circle which is the isometric projection of the sphere. It is further necessary to say that the projections of lines which are not parallel to the edges of the cube, i.e. lines which are not isometric, and the projections of irregular curves are to be found by plotting the isometric projections of points on these lines and curves and joining the points thus found. The projections of the points may be found by referring to known points or lines in the figure and laying off the distances in the proper directions.

In Fig. 2 is illustrated the method of obtaining the isometric drawing of the circle. The circle is first drawn in its true size and the diameter is divided into any number of equal parts, 1, 2, 3, etc. Ordinates cutting the circumference are erected at these points. Having obtained the isometric projection of the center of the required circle, draw the diameter in the proper direction, depending upon whether the circle lies in either one of the vertical planes or in the horizontal plane, divide it into the same number of equal parts as before and erect ordinates. Taking the distances from the points on the diameter to the circumference of the circle lay them off on these ordinates, using the corresponding points of division. When these points are joined with a smooth curve the result will be an ellipse and the required projection of the circle. The advantages of this ordinate method of determining the ellipse are that if it is carefully done, it has very little distortion, while any approximate method using circular arcs is bound to be more or less distorted. If the circle is drawn to one side of the main figure the drawing need not be complicated with unnecessary lines, for a little practice will obviate the necessity of drawing the ordinates of the ellipse and the distances may be laid off at the edge of the set square held in the correct position. Furthermore, the construction is easy to remember as it is not necessary to call to mind constructions for finding the centers of the circular arcs.



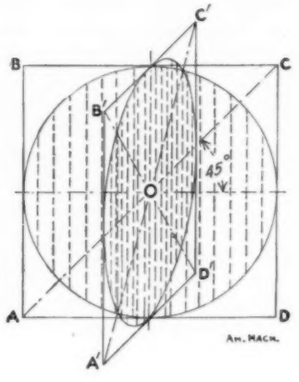
Cabinet Circle

Fig. 4



Oblique Projection

Fig. 5



Oblique Circle

Fig. 6

CABINET CIRCLE, AND OBLIQUE PROJECTION AND CIRCLE

CABINET DRAWING

Cabinet drawing is illustrated in Fig. 3. Here the cube, the circle and the sphere are treated in a similar manner to that explained in connection with isometric drawing. Cabinet drawing is entirely conventional, having no such rational basis as the isometric drawing. It is arbitrarily assumed that all lines shown in the face plane shall be true projections, and that lines perpendicular to the face plane shall be drawn at an angle of 45 degrees with the horizontal and laid off in their actual length. It will be seen that the projection of the circle in the median plane parallel to the face plane is a true circle with the actual dimension as a radius. The representation of the circle in the two other planes is an ellipse. Fig. 4 shows the method of obtaining the ellipse which lies in the horizontal plane. This is similar to that described under isometric projection, except that the diameter of the cabinet circle is drawn at an angle of 45 degrees. The radius of the projection of the sphere in this case is 1.3 times the true radius. Actually, in order that the projection of the sphere might be tangent to the projections of the three great circles, one of which is a true circle, the projection of the sphere would have to be that of an ellipsoid but, since the projection of the sphere on any plane is a true circle, this fact is disregarded.

The methods of oblique drawing are indicated in Fig. 5. These are similar to those of cabinet drawing, except that lines which are perpendicular to the face planes are arbitrarily laid off to half their actual length. The elliptical representations of the circles will therefore be much flattened in comparison with the other two methods. The construction suggested for the ellipse in Fig. 6 is again that using ordinates. In this case, however, the diameter of the oblique circle is laid off equal to one-half the actual length, and the divisions on the diameter of the oblique circle are one-half the length of those on the true circle. It will be noticed that the major and minor axes of the ellipse do not coincide with the diagonals of the oblique square. The radius of the oblique projection of the sphere is 1.06 times the true radius of the sphere.

In comparing the three methods, it is well to note that the oblique drawing seems to have less natural distortion than the other two. This method would, therefore, seem the best to use when the drawing is intended purely for illustration. Practically, on account of the ease of handling the insometric projection, it is greatly preferable in all cases where the drawing is to be dimensioned. Cabinet drawing is less suitable for most purposes than the other two on account of its greater apparent distortion, although it possesses advantages over isometric drawing in the ease of handling, since lines and curves in the face plane are shown on their true projection.

Draft in Drop Forging Dies

By F. J. Badge

Although 7 degrees is most commonly used as the angle of draft, larger angles are frequently necessary and several different angles may be used in a single die. A handy table of allowances for standard draft angles.

In sinking dies for drop forging, it is important that the draft at the sides of the impression should be made as little as necessary to avoid heavy cuts in the machining operations. It is equally important that the draft be sufficient to allow the forging to be easily withdrawn from the die, else production under the hammer will be hampered. The standard draft (or draw) for most dies is 7 degrees from the perpendicular, but other angles are used in special cases and sometimes two or three different angles of draft are used in the same die at different parts of the impression.

Fig. 1 shows the plan and side elevation of a lower die where three angles of draft are advisable. The shoulders *A* and *B* are places where the metal is likely to hug on account of the contraction of the hot metal along the part marked *C*, which is of comparatively small cross-section and will cool rapidly. Thus these shoulders are given an angle of 9 degrees. The inserted tool-steel plug *D* is another place where metal is likely to hug badly. It is usual to give such plugs 12 and even 15 degrees of draft on each

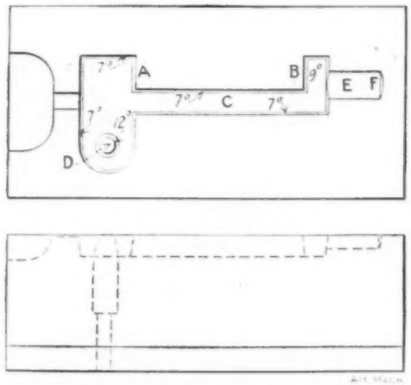


FIG. 1. EXAMPLE OF DRAFT IN DROP-FORGING DIES

side. Moreover, the tendency of plugs to get "jumped up," hammered over and badly heat checked is much reduced if they are given a big draft. The part marked *E* is semicircular and will, of course, draw easily. The end of *E* at *F* is a part of a sphere. From a strict consideration of the requirements of draft it should be conical, but a spherical end looks better on a round piece, and I suppose the universal practice of making them so is dictated by appearance only. All other sides of the impression are given 7 degrees draft. If the die is smooth and regular the forging will draw easily.

All impressions are laid out to one-eighth inch to the foot shrink rule. This allows for a shrinkage of about 0.010 inch to the inch. The same shrinkage is allowed in the thickness of forgings. For example: A forging is to be 2 inches thick with half the thickness in each die. The depth of impressions will be 1.010 inch in each die. In laying out the impression on the face of the die, allowance has been made for shrinkage in length, thickness and breadth of forging, and, in addition, for the draft on the sides. In complex dies where there are many different depths and offsets on the face of the die, the die sinker has to keep all these points constantly in mind while laying out or run the risk of spoiling the whole job.

A TABLE OF DRAFT DIMENSIONS

The allowance for 7-degree draft is easy to remember, being almost exactly 1/32 inch at the face of the die for each ¼ inch of depth. With other angles of draft it is not easy to memorize the allowances and it is strange we do not see more tables of allowances in a handy form. Table 1 has been calculated from a table of tangents and gives the allowances in thousandths of an inch on actual depth, as measured with an ordinary depth gage. It is not usual in marking out to work closer than 1/64 inch, but the arrangement of table in thousandths allows the nearest 1/64 inch to be taken. The best plan is to take the allowance for the angle at 1 inch depth as a constant and figure out the allowance for the particular depth wanted from the expression.

$$\text{Draft allowance} = \frac{CD}{1}.$$

Where C = a constant and D = the depth in inches.

Depths in Inches	Standard Draft Angles in Degrees			
	5	7	9	12
	Inches	Inches	Inches	Inches
	0.011	0.015	0.020	0.027
	0.022	0.031	0.040	0.053
	0.033	0.046	0.059	0.080
	0.044	0.061	0.079	0.106
	0.055	0.077	0.099	0.133
	0.066	0.092	0.119	0.159
	0.077	0.107	0.139	0.186
1	0.087	0.123	0.158	0.213
1¼	0.098	0.138	0.178	0.239
1½	0.109	0.153	0.198	0.266
1¾	0.120	0.169	0.218	0.292
1⅞	0.131	0.184	0.238	0.319
1⅞	0.142	0.200	0.257	0.345
1⅞	0.153	0.215	0.277	0.372
1⅞	0.164	0.230	0.297	0.399
2	0.175	0.246	0.317	0.425

TABLE 1. ALLOWANCES IN THOUSANDTHS OF AN INCH AT FACE OF DIE FOR STANDARD ANGLES OF DRAFT AND VARIOUS DEPTHS OF IMPRESSION

MAKING TYPES

A type, shown in Fig. 4, is generally used as a guide for chipping and scraping out the spherical end of the semicircular part *E*. It is not usual to make the curve on the end conform to any particular mean angle of draft. Most diesinkers

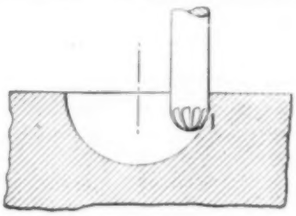


Fig. 2

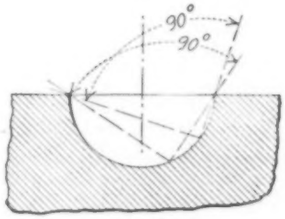


Fig. 3

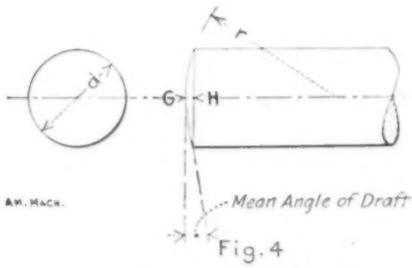


Fig. 4

METHOD OF TESTING CIRCULAR IMPRESSIONS AND LAYING OUT TYPE FOR DROP-FORGING DIES

merely turn the end of the type to a curve that looks right to the eye. However, uniformity is desirable in these curves and Table 2 is given as a help in that direction. It gives the values of the mean angle of draft with various radii expressed in terms of the diameter of the type. It will be noted that if the radius *r* is made twice the diameter of the type the mean angle of draft is 7¼ degrees. This rule is easy to remember and a good one to adopt as standard. A good and easy way to get a close approximation to the required curve is as follows: Turn a cylinder of tool steel to the re-

quired diameter. Face the end square. scratch off the distance *G H* equal to the allowance for draft obtained from Table 1, remembering that the depth is half the diameter of the type. Turn the end to a curve which is uniform to the eye from the center to the scratched line *H*. After the type is hardened it is ready for use.

Semicircular impressions are finished with ball cutters of the correct diameter. When a ball cutter of the correct diameter is not at hand and the job will not warrant making one, the following method proves very successful and quick. The center line of the impression is projected

When radius of end of type is	Mean angle of draft in degrees is
$2\frac{1}{2}d$	$5\frac{3}{4}$
$2\frac{1}{4}d$	$6\frac{1}{2}$
$2d$	$7\frac{1}{4}$
$1\frac{3}{4}d$	$8\frac{1}{4}$
$1\frac{1}{2}d$	$9\frac{1}{2}$

d = diameter of type in inches.

TABLE 2. MEAN DRAFT ON SPHERICAL ENDS OF CYLINDRICAL TYPE

to the end of the die. A semicircle of the correct diameter is described on the vertical surface of the end. After the impression is roughed out, a smaller ball cutter is placed in the chuck of the diesinking machine; the knee and slides of the machine are manipulated until the cutter is placed in relation to the semicircle, as shown in Fig. 2. A square is used to indicate when the curves of cutter and semicircle are coincident, as at *I*. The micrometer dials are now set, the lateral slide locked, the knee lowered away, the longitudinal slide operated until the cutter is in position over the impression and the ball tool sunk into the die until the micrometer dial comes to the position set at the semicircle on the end. A longitudinal cut is taken with this setting. The cutter is then placed in another lateral position and the operation of setting and cutting repeated. It may be necessary to perform this operation several times, and even then the result will be a series of gutters and ridges instead of a uniform semicircular impression. This inaccuracy is, however, readily corrected with the scraper and riffler.

It might be well to point out an aid in testing the accuracy of semicircular impressions. I suppose most diesinkers are familiar with the well known geometrical fact that, "The angle inscribed in a semicircle is a right angle," but few make practical use of that knowledge. The diagram, Fig. 3, shows the principle of the test. If the semicircle is true, the corner of the square will touch in all positions when the sides are resting on the edges of the impression. If the square rocks on the corner at any position, that spot is high and must be scraped down. The testing must be done before the "flash" is milled on the die. I have used this geometrical kink very frequently in making cast-iron dies in such a hurry there was no time to make ball cutters or even a type.

Society of Automobile Engineers Screw Standard

The only changes that have been made by the Society of Automobile Engineers in the old screw standards of the Association of Licensed Automobile Manufacturers are the distances across the flats of the heads and nuts of the ¼-, ⅞- and ¾-inch screws; the changes being from ⅜- to $\frac{7}{16}$-; from $\frac{11}{16}$- to ⅝-, and from 1⅛- to $1\frac{1}{16}$-inch respectively.

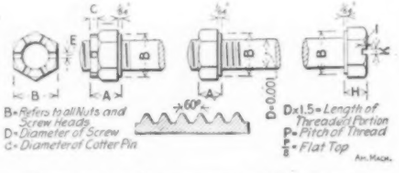
Dimensions. All dimensions are in inches.

Finish. All heads and nuts to be semi-finish.

Material. For all screws and nuts—steel; tensile strength, not less than 100-000 pounds per square inch; elastic limit, not less than 60,000 pounds per square inch.

D	¼	5/16	3/8	7/16	½	9/16	5/8	11/16	¾	13/16	⅞	15/16	1	1¼
P	28	24	24	20	20	18	18	16	16	14	14	12	12	12
A											1	1⅛	1⅛	1⅛
A_1													1⅛	1⅛
B								1	1⅛	1⅛	1⅛	1⅛	2	2⅛
C														
E														
H													1⅛	1⅛
I														
K														
d														

Screws are to be left soft. Screw heads are to be left soft. The plain nuts are



SOCIETY OF AUTOMOBILE ENGINEERS SCREW STANDARDS

to be left soft. The castle nuts are to be case-hardened.

It is assumed that where screws are to be used in soft material, such as cast-iron, brass, bronze or aluminum, the United States standard pitches will be used.

Tolerance. The body diameter of the screws shall be one-thousandth (0.001) inch less than the nominal diameter, with a plum tolerance of zero and a minus tolerance of two-thousandths (0.002) inch.

The nuts shall be a good fit without perceptible shake.

CLEARANCE BETWEEN TOPS OF THREADS AND BOTTOMS OF THREADS

The tap shall be between two-thousandths (0.002) inch and three-thousandths (0.003) inch large.

Diameter in Inches	Size of Taps, Thread	Drill Sizes, Inches
¼	28	7*
5/16	24	F
⅜	24	Q
7/16	20	W
½	20	29/64
9/16	18	33/64
⅝	18	37/64
11/16	16	41/64
¾	16	45/64
13/16	14	49/64
⅞	14	53/64
15/16	12	57/64
1	12	61/64
1⅛	12	1 5/64
1¼	12	1 13/64

*No. 5 drill gage.

Representing Galvanized Iron

BY LYNNE PASCHALL

Some time ago I was making some drawings of machines that had panels of galvanized iron. The drawings were for mailing purposes and it was desired to have them accurately illustrate the machines. They were given some line and surface shading but they still looked flat and failed to give the proper effect. Something had to be done to make the panels look right.

Now to represent galvanized iron on a drawing is no easy trick but this was a doubly difficult task because the drawings were to be blueprinted. Any kind of surface shading is apt to cause a sensation when blueprinted but galvanized-iron shading, no matter how good on the tracing, looks atrocious on the print.

After a lot of experimenting, I finally stumbled upon the following simple method:

Take a piece of small-figured galvanized iron and fasten the tracing down over it, dull side up. It does not matter on which side the drawing is. Then rub over the parts to be shaded with a dull lead pencil in the same way that we used to draw pennies at school.

The work should be done carefully. Make long parallel strokes and be sure that every spot is gone over. Make the shading uniform and quite black.

This surface when blueprinted will give a fairly good representation of galvanized iron.

If the pencil marks are inclined to smear, spray a little fixatif over them.

If brass molding is to be done regularly a supply of suitable molding sand is to be secured from one of the regular foundry supply houses, but if only an occasional casting is to be made, fair work may be obtained by selecting the finest molding sand used and then sifting it through a No. 16 sieve, using the fine material as a facing.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Why Drills Split

There is frequently much speculation as to the cause of drills splitting up the middle. The most common opinion is simply that it is because the drill is weakest there. This is, of course, not the direct cause. The drill is subject to torsion and fracture, though torsion would occur at the periphery of the drill before the elastic limit of the metal at the center of the drill could be reached.

Longitudinal central splitting of drills has a definite cause, which is nothing more nor less than a defect in the design of the drill section commonly used.

Fig. 1 illustrates diagrammatically the section scheme of the type of drill now commonly used. This is ordinarily called a two-lip drill, which is incorrect, as it has four distinct and separate lips, *A, B, C* and *D*.

This may best be illustrated by the following:

Fig. 3 represents a section of brittle wire held between vise-jaws.

Apply sufficient pressure to the free ends of the wire as indicated by the arrows and we will have the result shown by Fig. 4, fracture occurring at *R* and *S*.

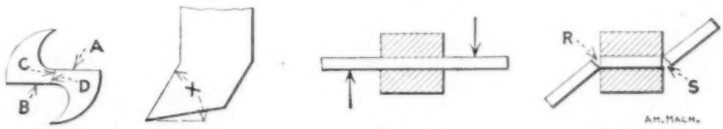


FIG. 1 FIG. 2 FIG. 3 FIG. 4

WHY DRILLS SPLIT

In any metal-cutting tool (the drill is simply a multiplicity of cutting tools integrally connected) the cutting resistance is proportional to the angle of the lip, the angle *X*, Fig. 2.

In the drill, the cutting edges *A* and *B* are at an angle of 59 degrees to the longitudinal axis of the drill if the customary included angle of cutting edges (118 degrees) is used in end grinding. Hence the lip angle of that part of cutting edge *C* adjacent the cutting edge *A* is 149 degrees, and owing to the increased clearance of cutting edge *A* from the periphery to the center of the drill, the lip angle of cutting edge *C* actually increases as the center of the drill is approached. The same is, of course, true of cutting edge *D*.

The lip angle of cutting edges *A* and *B* varies in the ordinary drill from about 65 degrees at the periphery of the drill to 90 degrees at the center, hence has an average of about 77½ degrees.

CUTTING RESISTANCE OF DRILLS

The cutting resistance is independent of the cutting speed, hence while their average cutting speeds vary, the cutting resistance of *C* and *D* is greater than that of *A* and *B*, and longitudinal fracture occurs.

In this illustration the free ends of the wire represent the cutting edges *A* and *B* of the drill, while that part of the wire held in the vise represents the cutting edges *C* and *D* or the chisel point. The vise jaws take the place of the work in which the chisel point is imbedded and the fracture *R* and *S* the longitudinal splitting. It is logical to assume that fractures *R* and *S* will unite in the case of the drill. The pressure indicated by the arrows in the illustration represents the drive transmitted to the drill by the machine.

A. C. VAUCLAIN.

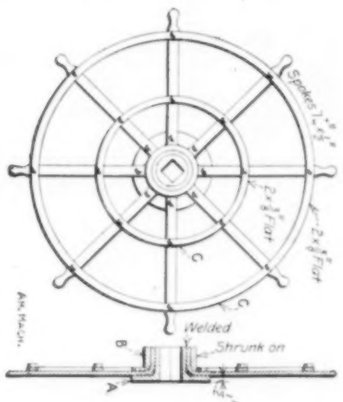
Philadelphia, Penn.

A One Piece Forged Capstan Wheel

While the caption is not strictly true, still the arms and part of the hub of this wheel are in one piece. The most interesting pair of handwheels it has even been my fortune to see, are used on a large folding machine in a shop making galvanized hollow ware.

As an antique the machine is interesting, as it has stood in the same position for over 60 years and is still doing good service. The original wheels actuating the clamping mechanism did not give sufficient power to hold material several gages thicker than intended, so a new pair were made to take their place.

The smith who made them was no ordinary man. Taking a piece of 5-in. hydraulic tubing, roughly, 3 ft. 6 in. long, he split it lengthwise 2 ft. 9 in., making eight cuts. Heating the still solid end of the tubing he turned the severed sections at right angles; i.e., spread them out into the same plane. Next he prepared a hub *A*, leaving a square hole to take the shaft and a flange, as shown in the cut. This fitted the hole in the tube. The center of the partially made wheel was then raised to a welding heat and closed. Not feeling confident of the strength of the hub he made a ring *B* external to the hub and shrunk it on.



ONE-PIECE CAPSTAN WHEEL

Two bands *C* fastened to spokes and the ends of spokes shaped for a hand grip completed the job. The illustration renders the construction clear. As a sample of a strong wheel it left nothing to be desired; two and sometimes three men, pulling at the same time, had no effect on it after years of service. The wheels have been treated as no cast-iron wheels could have been without being broken. If a pile of sheets slipped and bent the wheels slightly they were easily straightened.

No doubt the cost of the wheels was high, but there is something in the idea other than novelty after all. With seamless tubing of any thickness to be had and a circular cold saw available, such wheels, when required of large size and in limited quantity, might prove cheaper than cast iron needing, as it does, an expensive pattern. The wheel illustrated would be stronger than a cast-iron wheel

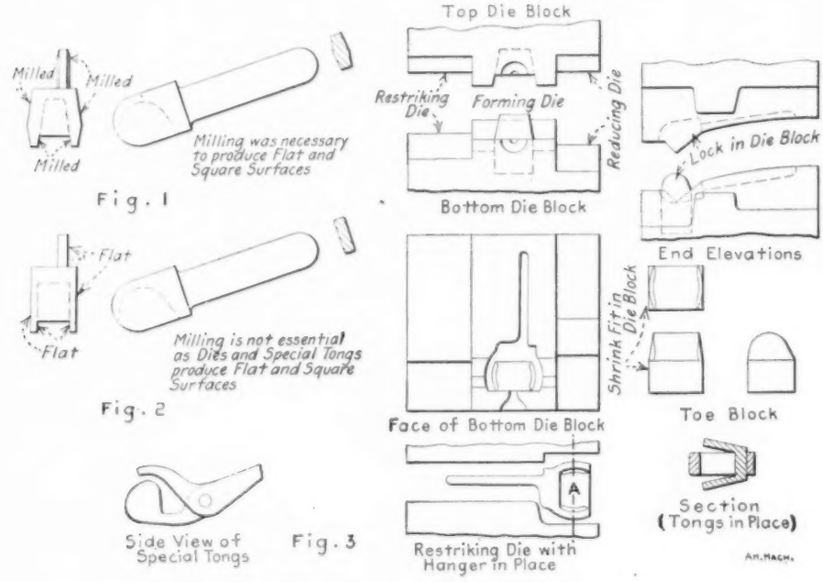
of the same weight. And its nonliability to damage proved a feature of considerable value in the shops where I saw the machine in use.

London, England. A. L. HAAS.

Forging Dies for an Automobile Hanger

These forging dies were designed to make an automobile front-spring hanger so that machining is rendered unnecessary; drilling being the only necessary operation.

Fig. 1 shows the forging as it was formerly made. Owing to the draft in the dies, milling was necessary where indicated. To get these places to a smooth flat surface the following set of forging dies was devised and put into successful operation.



FORGING DIES FOR AN AUTOMOBILE HANGER

Fig. 2 shows the forging which these dies made.

Fig. 3 shows the dies in all views; the lock in the dies to attain alinement; the tapering toe block to produce the bell-mouthed appearance as shown at *A* on the restriking die, and the special tongs which are placed in *A* to bring the surfaces square and flat while being restruck. The stock is broken down in the reducing die and is then stamped in the forming die, which has the usual draft. The toe block is shrunk into the lower half of the die and, as stated, gives the bell-mouthed effect.

The forging is then trimmed to get rid of as much of the fin as possible. The final operation which brings the forging square and flat is then completed in the restriking dies. The forging is held at *A* by the special tongs placed on the restriking die, which is machined to the contour of the finished hanger, and is thus brought to shape. These dies are right hand and left hand, as the hangers must fit accordingly. One of the largest automobile shops is using these dies in producing the hanger described.

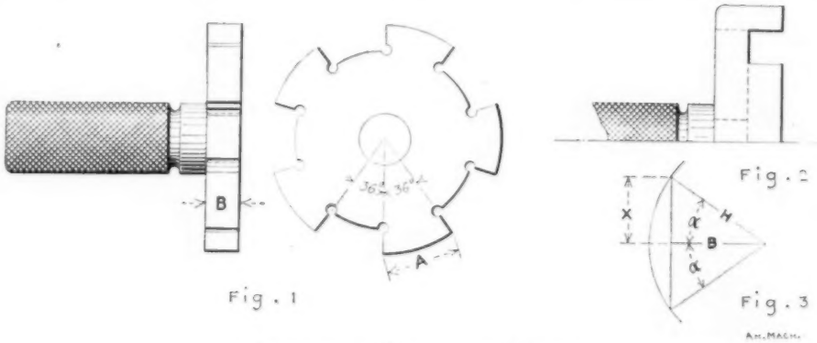
Hamilton, Ohio. P. SANDIESON.

Grinding a Hub Clutch Gage

A hub clutch gage is in frequent use in nearly all automobile factories and on account of the difficulty in grinding, it is generally left soft. Therefore it is not long until another gage must be made to replace the one worn out in usage.

This grinding is accomplished as follows: After turning the blank to the required size on an arbor, ten small holes are drilled through it, as shown in Fig. 1, and in such a position as to afford clearance for the emery wheel. The stock is then milled out between the teeth, leaving 0.015 to 0.020 on each face to grind. After hardening it is replaced upon the arbor and mounted between centers on a miller, using the universal head to index the 36 degrees or 10 divisions as shown in Fig. 1.

The shank of an electric center grinder is fastened to the miller mandrel and the back gears thrown in so as to lock the spindle from turning. It is necessary to get the grinding face of a saucer wheel on exact line with the centers and as the wheel wears, move the work over so as to keep it on line with the centers. After grinding off the amount left for grinding, the work is reversed on centers, and the wheel reversed to match and the other faces ground until the dimension *A* as measured by a pair of micrometers is correct on all the teeth.



GRINDING A HUB-CLUTCH GAGE

If a male gage for the clutch is required, it may be made on the same general plan, except the dimension *B* should be doubled and the face of the gage recessed, as shown in Fig. 2, so that the two gages would fit together. It might be necessary to lap the faces a little in order that each tooth of the male gage would enter the corresponding slot of the female gage.

As dimension *A* varies with the different diameters of hubs and clutches on the various makes of cars, it may be of interest to show a sample problem.

Suppose the diameter of the gage blank is $3\frac{5}{8}$ inches, referring to Fig. 3, let

X = Altitude
B = Base
H = Hypotenuse
α = Angle

$$H \times \sin \alpha = X$$
$$1\tfrac{13}{16}'' = \text{radius or } H$$
$$1\tfrac{13}{16} \times 0.30902 = 0.560$$
$$0.560 = X \text{ for } 18°$$
$$2 \times 0.560 = 1.120$$
$$1.120'' = \text{dimension } A.$$

Indianapolis, Ind. G. W. LINN.

Sanitary Drinking Fountains

We never have had anything on which the Chinese have not put in a claim for priority of invention.

The mariners' compass was in common use in China when Ptolemy I was sailing papyrus boats in the gutters of ancient Egypt. Gunpowder, silk manufacture, printing with movable type and many other things are claimed by them. According to recent reports in the daily papers no Chinese home of 2000 years ago was complete without a phonograph.

In fact, even those who, by stress of circumstances and to avoid the grasping landlords of that early time, were compelled to live in caves were cheered in their exile by a phonographic rendition of "Mr. Brown, what yo' gwyn to do when de rent comes roun'."

In one of these caves, a complete phonograph has been found; so says the daily press.

I started out to tell you of one invention the Chinese cannot claim, that is, the sanitary drinking fountain. However, although they did not invent it, a nation nearly, if not quite as old, has had it in constant use since (if not quite the *dawn*) the early forenoon of time.

In India it is unclean to touch with the lips what another has touched with his lips. When a number of workmen or women are on a job where it is not convenient for each to have his own drinking vessel the water "boy" (usually a girl) runs the water from the spigot into a receptacle, which has a spout on the side. The thirsty one holds this vessel 6 or 8 inches from his mouth and 3 or 4 inches above it, tilts the receptacle and the water gushes out of the spout and into his mouth.

New York, N. Y. E. A. DIXIE.

A Milling Fixture

This fixture produces the part shown at *X*. Extreme accuracy is required and one fixture is preferable to several, as it necessitates only one setting and we avoid the possibility of error in that direction.

Fig. 1 is the blank which is turned and cut off to exact length in a screw machine. Fig. 2 shows the blank straddle milled, which can be done in special jaws in the miller vise. Distance *A* should be a little more than the width of the cutter to allow for cutting off.

Fig. 3 is the first operation in this fixture. The blank is set in the spring chuck and squared up by the set piece as shown. This set piece is removed before cuts are taken. A cut is taken across the top as shown at *B*.

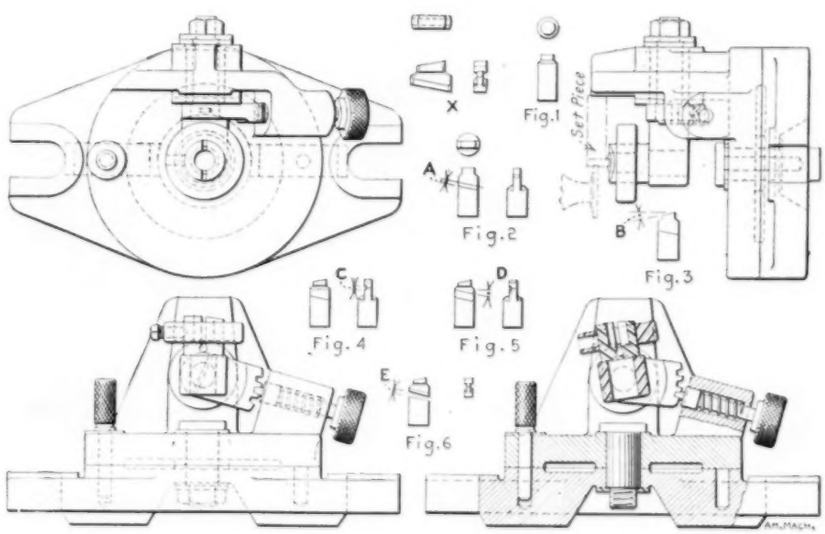
Fig. 4 shows a cut at *C* after the chuck has been moved one notch on the index. Fig. 5 shows the cut at *D* finishing one side. The opposite side can be produced the same as at Figs. 4 and 5, by swinging the upper half of the fixture 180 degrees and indexing by the pin.

Fig. 6 is the last cut, as shown at *E*. The sectional vise gives an idea of the details and is indexed for either the last cut, *E* Fig. 6, or *D* Fig. 5.

I have tried to make this as simple as possible, leaving off the block spots for depth of cutter which would only confuse those who are just beginning to be interested in the subject of tool design

A stem cutter is used in vertical milling attachment with this fixture.

Salem, Mass. J. A. POTTER.



THE WORK AND THE FIXTURE

Hardening in Gas or Oil Furnaces

The plan of hardening high-speed steel cutters and dies in an open-type gas furnace is not as reliable as the average man might think, for in every instance the effect of the gas or air in uneven proportions invariably has a bad effect, blistering the steel and causing the outside to be soft. Experience has taught me to keep the gas or oil flame from coming in contact with the steel, which can best be accomplished by getting a crucible, open at one end, and setting it in the furnace. If this cannot be had, use a sheet of heavy asbestos and bend it in the furnace so as to form a crucible over the die or cutter.

It is also a very good scheme to mix ivory drop black and oil, to the consistency of paste, and spread on the die or cutter. As the steel gets hot the oil burns off, leaving the ivory black, and this material, being very light and fluffy, immediately floats off the steel when immersed in the oil. One very economical point is that you need only protect the part of the die or cutter that is to be put into service. I do not believe that any gas or oil combustion can be generated which will not have some detrimental effect on the steel, so that the best solution lies in protecting the steel from coming in contact with the flame.

Another very good plan is to make a bag of thin asbestos, put tool in it and tie up tight. When the steel is heated enough, put it over the oil and break the bag.

To get the best results obtainable out of a gas furnace the gas and air mixture must be of proper proportions, and there should always be from six to eight times more air than gas and they should not be proportionate in pressure so much as in mixture. It is not sufficient to have 2 oz. pressure of gas and 16 oz. pressure of air; you must have 8 cu.ft. of air and 1 cu.ft. of gas, and 16 oz. of air pressure to 2 oz. of gas. This is a very valuable point and one that even the gas-furnace manufacturers have not realized. A dark-blue flame will positively give the best heat, while a light blue shows too much air and a yellow flame, too much gas. If you will regulate your furnace to the foregoing, you will have the best possible combustion for hardening high-speed steel in a gas furnace.

I might add that a very damaging point to contend with is the opening of the door of the furnace, as this allows air to enter and immediately changes combustion. A door with a perpendicular slide is by far the best, as it enables one to use the smallest opening.

It is also a good thing to have a slot big enough to allow the tools to slide through, cut in the firebrick platen a few inches back from the door, and have a square sheet-iron pipe leading right down into your oil bath from this opening. This keeps air from striking the steel at any time, thereby obviating the necessity of at any time having to open the large door.

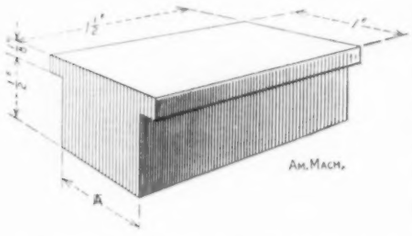
CHARLES H. DICKSON.

Chicago, Ill.

Locating Tongues for Fixtures

Many milling and other fixtures have tongues to locate them in the T-slots of the various machines on which they are used. In some cases these tongues are a part of the base casting itself, while in others they are separate pieces of steel fitted into slots in the bases of the fixtures. In either case the tongue is a single positive size. That is to say, if the jig is to be used on a machine table having ⅝-inch T-slots, a ⅝-inch tongue is

formed on the base of the fixture, or if a steel tongue is inserted a 5/8-inch slot is cut in the bottom of the fixture for its reception. If, for any reason, it is desired to use the fixture on a machine having 3/4-inch T-slots in its table, there is considerable trouble to get the fixture alined.



LOCATING TONGUES FOR MILLING AND BORING FIXTURES

We overcome this difficulty in the following manner:

The bases of all fixtures for milling and horizontal boring machines have a slot or groove cut across the bottom 1 inch wide by 1/2 inch deep. The dimension *one inch* must be accurate. Each machine is equipped with two or more tongues, as shown in the line cut, whose dimension *A* is a snug fit in the table slots, and the 1-inch dimension a snug fit in the groove in the fixtures.

As the slots in the different machines vary, it would be well before hardening to number the keys with the same number as the machine they fit. They can be kept with the machines as a part of its regular equipment, or in the tool crib and issued on check.

Indianapolis, Ind. G. W. LINN.

Photographs for Your Notebook

If you take a strip of tracing cloth and attach it to one of the spools of your kodak and stretch it over to the other spool in precisely the same manner as you would a film you get a focusing screen which almost equals ground glass.

Of course, having replaced the tracing cloth with the film and made the exposure, you cannot rewind the film and it looks as if one had to take all six exposures or waste the unexposed; but I have found it to be an easy matter to go to a dark closet or temporary darkroom and take the film completely out of the kodak and rewind it, working in the dark, taking care, of course, to note how many exposures had been made.

I have seen and have a number of copies of drawings taken in this same way, using a portrait attachment furnished by the makers for fifty cents, and pinning the drawing to the wall in a suitable light. This makes a very neat way of keeping a record in one's own loose-leaf book for future reference. The printing and every detail stand out quite clearly when a little care is exercised.

Springfield, Ohio. P. C. VERE.

Refitting Pulleys

I have used the following method in repairing friction clutch pulleys and loose pulleys and I have also applied it where the shaft was worn and cut smaller than the original size.

I first trued up the worn portion of the shaft, which would then be about 1/16 inch smaller than the original size, as shown in Fig. 1; I cut enough drill rod about 1/4 inch diameter, a trifle shorter than the turned part for the rollers, as in Fig. 2. Then caliper the turned part,

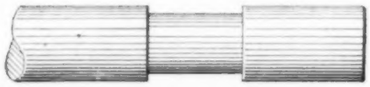


Fig. 1

Fig. 2

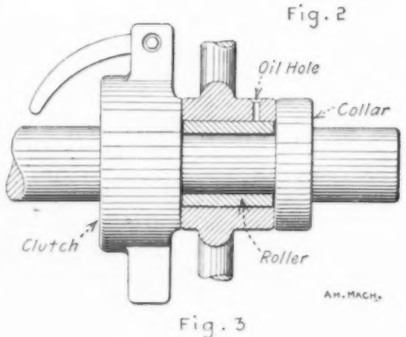


Fig. 3

REFITTING PULLEY

add 1/2 inch or twice the diameter of the drill rod to be used, and then rebore the pulley a trifle large for a running fit. Then assemble as shown in Fig. 3.

Philadelphia, Penn. W. D. SLOCUM.

Rope Pull Including Friction of Pulleys

Let it be required to hoist a load on several parts of rope. What pull will be necessary, making proper allowance for the friction in the sheaves of the blocks?

In the accompanying figure, P represents the required pull. Allowing 6 per cent. as the loss by friction in going around each sheave, which is in accordance with customary practice, the pull in part 1 will be $P \times 0.94$; in part 2, $P \times (0.94)^2$; in part 3, $P \times (0.94)^3$; and so on to the nth part, the pull in which will be $P \times (0.94)^n$. The n pulls combined equal the load S; thus,

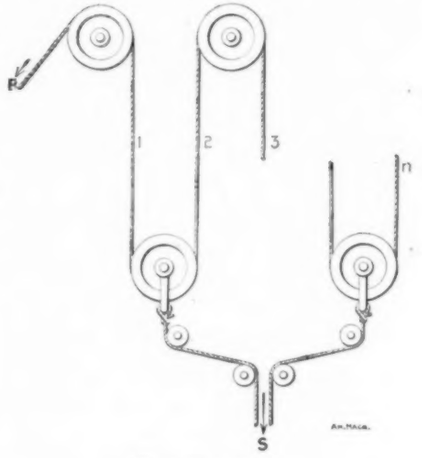
$$S = P \times 0.94 + P \times (0.94)^2 + P \times (0.94)^3 \ldots + P \times (0.94)^n. \quad (A)$$

It will be seen that this equation represents the sum of a geometric progression, the formula for which is

$$S = a\frac{r^n - 1}{r - 1}. \quad (B)$$

a being the first term, r the constant multiplier and n the number of terms.

From equation A, $a = P \times 0.94$, $r =$



THE DIAGRAM

0.94 and n the number of terms. Substituting these values in equation B,

$$S = 0.94\,P\frac{0.94^n - 1}{0.94 - 1},$$

solving which,

$$P = S\frac{0.06}{0.94\,(1 - 0.94^n)},$$

or

$$P = SC$$

The appended table gives values of C for different values of n:

n	1	2	3	4	5	6	7	8	9	10	11	12
C	1.06	0.55	0.38	0.29	0.24	0.21	0.18	0.16	0.15	0.14	0.13	0.12

Example—What rope pull will be required to lift a load of 20 tons with a 6-part block?

Solution—From the table

$$n = 6,\ C = 0.21,$$

and the pull required is

$$20\ \textit{tons} \times 0.21 = 4.2\ \textit{tons}.$$

ALFRED ENGLERT.

Brooklyn, N. Y.

Saving the Draftsman's Time

I have concluded that there is no short cut for the layout man, and that time saved by rapid laying-out is eventually lost in studying out what to lay out. It requires a certain amount of time to think out the work, and regardless of how many short cuts are introduced into the actual drawing, they make little or no difference in the total time required.

In making drawings from a layout, as pattern drawings, or single-piece drawings, to a different scale, I have a short cut that is saving lots of time. I cut a piece of cross-section paper the size of the tracing and tack it underneath the

tracing cloth or paper. Where radius and straight line meet, by drawing them in with pencil on the tracing they look neater, but the majority of the lines can be inked direct on the tracing. A ⅛x⅛ to 1 in. green cross-section paper gives the best satisfaction. This can be easily divided into fourths (1/32 in.) by the eye.

I have made small layouts over 1/16 to 1/16 to 1 in. paper directly onto the tracing with quite a saving in time used in scaling.

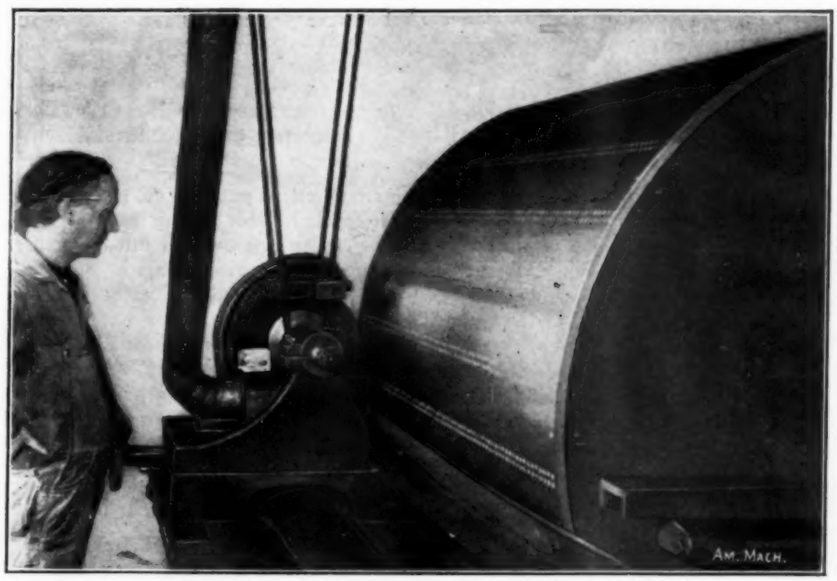
GEORGE M. MEYNCKE.

Kings Mills, Ohio.

Grinding a Large Cast Iron Drum

The accompanying halftone shows a grinding operation of more than usual interest, the work being a cast-iron drum 60 inches long and 60 inches in diameter. The grinder, which was designed especially for this purpose, was built for one of the largest manufacturers of wool and worsted machinery in New England, and is quite simple as to the number of parts, but is very effective.

The grinding wheel used on this machine is carborundum, 14 inches diameter, 1-inch face, 6-inch hole, 161 grit, M grade, B-3 bond, and is run at a speed of 1300 revolutions per minute, the grinding being done dry and the dust carried away by suction through a 3-inch tin pipe, connected to a cast-iron hood that nearly encircles the wheel.



GRINDING A LONG CAST-IRON DRUM

The wheel spindle runs in phosphor-bronze boxes and is driven by two belts, one on either side of the wheel. The carriage is fed along by a coarse lead screw, and the reversing mechanism is simple, consisting of a positive clutch mounted between two pulleys running in opposite directions, on one end of the screw.

The drums are first turned in a lathe, 0.020 inch being left for grinding. The drum is then mounted on its own shaft in two boxes attached to the side frames of the grinder, and is run at a speed of 45 revolutions per minute, which gives a surface speed of approximately 700 feet per minute, which is a high work speed, but gives excellent results. The traverse speed of the wheel is approximately 30 inches per minute, giving an advance of one-half the width of the wheel for each revolution of the work.

It may be added that a good finish does not count, the object of the grinding being solely to make the drums round and straight, and the finish obtained resembles that left by a bastard file when used on cast iron in the lathe. The time consumed in reducing the drum 0.020 inch is two and a half hours, removing approximately 114 cubic inches of stock.

F. B. JACOBS.

Niagara Falls, N. Y.

A Replacement Blank

Attached is a form used for some years past by one of the large machinery manufacturers of the country in ordering the replacement of any part which has either been spoiled in casting or machining or has been diverted to some use other than that for which it was originally intended. This, while very simple in its composition, has been so arranged as to make a complete reference; and it serves to call the attention of the supervising officials to the possibility of a delay in shipping the machine, as a result of the nondelivery of this part on time.

Furthermore, the form is printed on a light carmine paper—an indication that it is to be given precedence over other work, the same as a "pink" telegram is rushed through before other messages. This fact is taken advantage of to use the same blank, with the word "Replace" striken out to put through original parts which are needed in a great hurry, particularly where they have been previously overlooked; but care has been taken not to have that practice overdone.

REPLACE ORDER

No. of Pcs. ..... Kind of Mat'l. .....
Name of Part. .....
.....
.....
.....
.....
.....
.....
.....
.....
Pat. No. ..... Draw. No. .....
Signed. .....
Inspector
Dept. .....
Approved .....
Supt. or Foreman
Approved .....
Matl. Supv.
To Dept. .....
Cause. .....
Charge to No. ..... Disposition .....
Date Req'd. ..... Deliver to .....
Job Name. .....
.....
Last Operation .....
.....
For Order No. ..... Date .....

O. B. SIRVER.

Milwaukee, Wis.

Red versus Black Ink

Engineers of steel structural work long since discarded the use of red ink for dimension and center lines on drawings, but mechanical engineers are divided in their practice. The result in the finished blueprint of a fine, continuous black line is much better and the intersections are clear and sharp, while still contrasting well with the heavy lines of the figure. The wider and dimmer lines made by red ink have no advantage, but on the contrary, are a disadvantage in poorly lighted shops.

The many cleanings of the pen required when using two colors take time, and so does the drying of red ink, which remains wet for quite a while; on the contrary, little skill is required to adjust the pen from fine black to heavy or *vice versa*, and the fine lines are dry almost instantly.

Every tracer ought to be able to adjust his pen quickly and surely anyway, so as to make the dotted lines that represent invisible parts of the figure lighter than the solid lines and thus make a clearer drawing.

Moreover, when erasures are required, the fine black line comes off easily and quickly, and wears and stands handling better than red, whereas red is hard to erase, requires much more time, and leaves the cloth in a damaged and weakened condition.

Then, too, the red lines look plainer on a tracing, and that is a disadvantage, because the draftsman cannot help relying somewhat on color when making the tracing, and a line that was clear because it was a different color loses that clearness in the print where clearness is most wanted.

Scottdale, Penn. F. D. BUFFUM.

A Simple Hobbing Fixture for Bronze Worm Wheels

This fixture was designed for the purpose of hobbing several thousand small bronze worm wheels about 2½ inches diameter and ⅝ inch width of face.

The gears are first machined to size in a turret machine, after which they are finished on the attachment shown, used in conjunction with a Whitney hand miller. The base of the fixture *A* is cast iron; circular in form with suitable projecting flanges on its lower portion for attachment to the platen of the miller, by means of T-bolts and nuts and tongues *E*.

The revolving arbor *C* is hardened tool steel, and has a tapered upper portion which takes the thrust of the cutter and serves to center the arbor in its bearing in *A*.

A driving worm wheel *D* is attached to the lower end of *C* by a key and nut, and meshing into it is the steel worm *J*, mounted on a horizontal shaft whose bearing bosses are cast integral with *A*.

Suitable thrust washers between the ends of the worm and the inner faces of the bearing bosses serve to absorb the worm thrust.

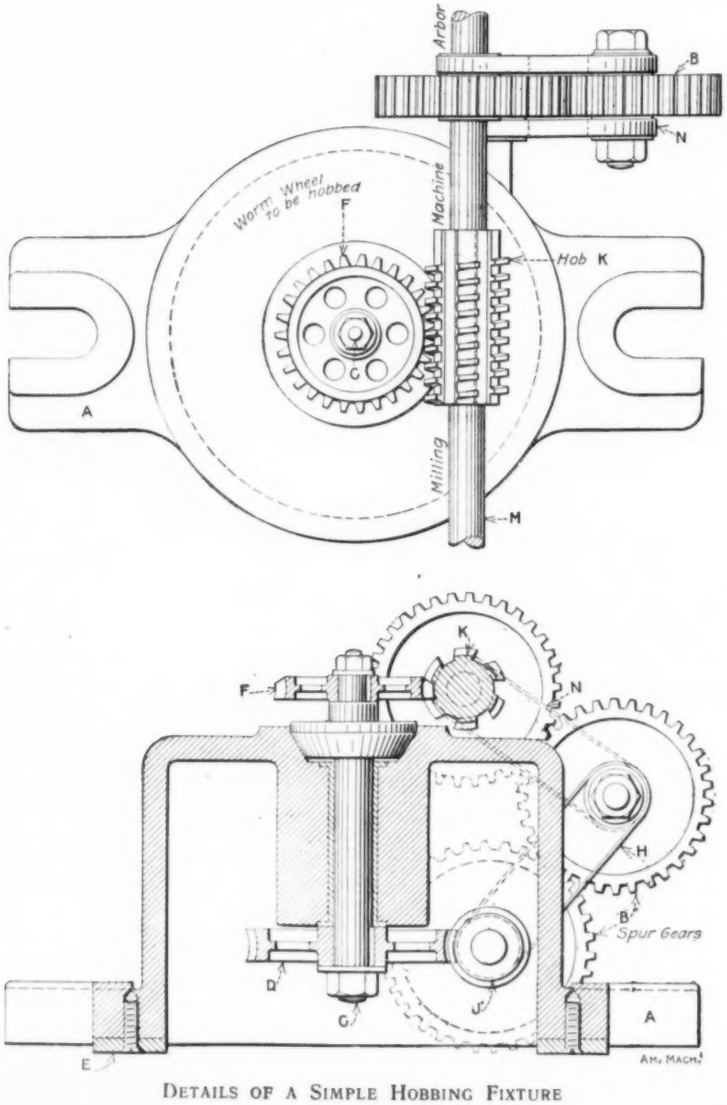
A cast-iron spur gear is attached to the end of the worm shaft outside the base *A* and is the lower member of a train of three spur gears *B*, which transmit the power from the miller arbor *M* to the revolving worm-wheel arbor *C*.

The idler gear is mounted at the junction of the steel side links *H* and *N*, this construction permitting a flexibility in the gear train and enabling the miller platen to be elevated or moved back and forward to accommodate the work in hand. The wheel to be hobbed is shown at *F*. The upper gear is mounted behind the "hob" *K* on the miller arbor.

It will be seen that this attachment is in reality an embryo hobbing machine, and it has paid for itself many times since its introduction to the shop where it is in daily use.

Should the production of similar worm wheels warrant it, a multiple-spindle fixture of the above type could readily be devised.

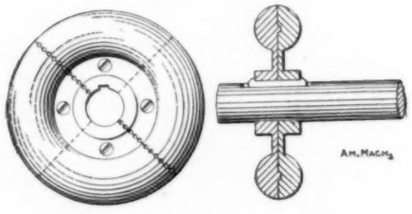
Detroit, Mich. ARON LAWRENCE.



DETAILS OF A SIMPLE HOBBING FIXTURE

A Hurry Up Job on a Handwheel

The horizontal shaft on a boring mill that furnished motion to the vertical spindle had the handwheel on the end outside of the housing. It was very inconvenient when a small job was on; hence we concluded to put a sliding wheel inside, and as there was a rush of work, we did not wish to stop and take the shaft out to put one on. We found a pattern and had a casting made of each half. The two parts were fitted together with tongue and groove, a row of small holes was drilled across center of each and it was parted. It was put together with joints at right angles and clamped, four small screws were put in the web, and then it was bored, turned and keyseated for the feather. It took about 10 minutes to put it on the shaft and it gave entire satisfaction. The wheel on the shaft is shown in the accompanying figure.



THE HANDWHEEL AND HOW IT WAS MOUNTED ON THE SHAFT

Birmingham, Ala. W. B. ODELL.

Some idea of the beauty of having different systems of measurement can be had by a slight consideration of what our Cuban friends are up against in some particulars. Land is measured by the Cuban yard, which is approximately 0.848 meter. Cloth is measured by the Spanish yard, said to be 0.836 meter, while carpentry work is measured by the American foot, and surveying is done with the French meter. Land area is given in "Caballeria" which equals about 134,000 square meters. Distances are measured in leagues which equal 5000 Cuban yards.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Dimensioning Drawings

The article entitled "Dimensioning Drawings," Vol. 35, No. 21, adds to the already plentiful list of suggestions regarding the making of shop drawings, and the saving of the draftsman's time.

In the first place it is claimed that by placing all the dimensions to read horizontally it would be easier for the shopman to work from the drawing. This may be true in that it is not necessary to shift the blueprint or crane one's neck in order to read vertical distances, but in a complicated drawing with many dimensions it would be very apt to confuse. Also, the workman cannot tell at a glance if a figure is meant for a horizontal or vertical distance, as he can with the system now employed.

Mr. Park lays particular stress on the saving in time effected by the draftsman by leaving out the inch marks altogether, and the arrow-heads on the paper drawing. It surely would require a keen-eyed tracer with a scale constantly in his left hand to locate the arrow-heads properly.

Let us have an abundance of suggestions of real time-saving methods and devices in the shop instead of needless planning and worry.

West Allis, Wis. P. M. SMITH.

Group System of Wage Payment

I have read with great interest the article by C. B. Auel, entitled "A Group System of Wage Payment," on page 966. It would seem to me to partake of the disadvantage of both piecework and the premium system. The limiting of the amount of wages paid to the base labor costs already in existence is nothing but a piecework price, but with this difference, the men only get half instead of all that is saved. Dividing the saving equally between the company and the men is nothing but the Halsey premium system with the payment made in money instead of time. But there is this great difference: The total labor cost is limited to the base labor costs already determined. And if for any reason, over which the men had no control, the wages should happen to exceed this limit they would only receive the amount of this base labor cost. Such being the case their earnings would fall below their day rate and they could not be held responsible.

This, to my mind, is the inherent defect of piecework. Would it be practical to offer the average floor gang the following proposition, such as I conceive the scheme of Mr. Auel's to be? "We will give you a fixed labor cost, and we will not pay any more than that. If you succeed in reducing this labor cost we will divide with you, we take half and you take half." Do you think that would appeal to them?

I cannot see that Mr. Auel has solved any of the problems peculiar to the gang systems. No matter how much is said to the contrary, no workman is willing to divide with the other members of the gang any saving he thinks he has effected by himself. You may be able to get his consent to it but you cannot convince him.

Instead of producing harmony it would seem to me that just the opposite effect would result. Jim is sure that Bill is not doing as much work as he is and he will be hanged if he is going to work himself to death to put money in Bill's pay envelope.

Let us consider some of the advantages claimed for this particular system, which do not appear in other systems.

1. Defective work reduced to a minimum. No more so than by piecework and premium systems. None allow anything for defective work.

2. Overrun limits, one of the greatest drawbacks of the premium systems, will be eliminated. Granted. But does this system offer any more incentive than other premium systems? Mr. Auel seeks to drive them to keep within the limit by limiting arbitrarily the labor cost rather than trusting to the inducements offered to lead them to this result. If the time limit is overrun there must be something at fault and it is not always the workman either.

One other point seems to me to be defective in this system. Does it furnish enough incentive to the charge hand to try to reduce the labor costs by using a cheaper grade of men? As I understand it any saving in this direction resulting from his efforts is divided among all the members of the gang as a part of the general saving. Is this incentive enough? In fact is he not planning to pay some of the men for a saving in which they did not assist?

All things considered, does not the whole scheme reduce to these facts? The company is not going to assume any of the responsibilities surrounding any job given out under this system, such as time losses due to crane waits, hard castings, defective tools, etc., all of which are out of the power of the gang to remedy. And yet they are proposing to divide equally the profits. In fact, the company is willing to divide the profits, but refuses to share the losses. It rather appears as though the company has both ends of the stick and the middle.

Barberton, Ohio. A. BRAND.

The Other Fellow's Honesty

May I be permitted to add to the articles by John R. Godfrey, on page 152, and by H. J. Mastenbrook, on page 658, an account of an incident which will illustrate still another phase of "the other fellow's honesty?"

The firm with which I am connected, recently received an inquiry for a quotation for several pieces of mechanism of an intricate nature, which were to be made in accordance with a drawing supplied with the inquiry. The intricacy of the work necessitated a fair amount of time being spent on estimating, the accuracy of the weight being important as it was largely of bronze. It was necessary to obtain prices for part of the work which would have to be purchased, and in so doing it came to our notice that at least two other firms in the district had received similar inquiries. This in itself, of course, was no more than usual competition, but its significance will be realized later on.

We submitted our quotation, and on subsequently following up the inquiry with a personal visit were told that they had decided to let the matter drop. From information by another source, however, we learned to our complete surprise that the work had been built in their own workshops previous to sending out the request for prices, and that this had been done simply to test the efficiency of their staff by comparing the cost as done in their own works with the cost of the same work in other shops.

So to our knowledge, there were at least three firms put to a considerable expense in estimating for work, which there was not the slightest intention to order.

A. E. DODWELL.

Leeds, England.

Locating and Boring Holes in Jigs

With reference to Thomas Jethart's article on page 990, the idea he uses in determining the center-punch mark accurately on the intersection of the two lines is very clever, but after he has obtained the exact location can he keep it? My opinion is negative unless he takes other precautions, such as using a transfer block, which I believe is common to most of us, or of bringing the center-punch mark concentric with the spindle of the machine in which he intends to bore the hole, for it is hardly necessary to mention that to drill and ream the hole on a driller from the center-punch mark means inaccuracy because it is almost impossible to keep a drill from running off center.

I believe the best method of boring jigs or dies is on a miller when any degree of accuracy is required, and the first thing to be decided is whether it is absolutely necessary to bore the holes within 0.0005 in. of each other; if so, then select the best miller in the shop and clean and oil it carefully.

Assuming that the one selected has a vertical head, we will place a piece of machine steel or brass about ½x5 in. in the chuck, letting about 3 in. stick out. Next place the vise on the table, put a lathe tool in it and take a light cut over the piece in the chuck and then measure carefully with a micrometer and it will probably show tapering because the vertical head is not set at right angles to the table. Decide which way it must go and set it accordingly, then continue the turning and measuring until the head is set true.

After the head is set true, we are ready to strap the jig onto the table, and in doing this care must be taken not to spring the work, the jig, of course, being lined up parallel to the table with an indicator.

Now, supposing, for example, that it is more convenient to measure this particular jig from the left end and also assuming that the distance from the end to the center of the first hole that you are to bore is 2 in., and that the diameter of the plug is 0.460 in., then the micrometer or vernier caliper should read 2.230 in., which is equivalent to the distance from the left-hand end of the jig to the center of the first hole plus one-half the diameter of the plug. The location of the hole crosswise of the jig may now be determined in the same manner, measuring either from the front or back of the jig, as most convenient.

The table is now locked, the measurements again made, which, if correct, the hole is ready for drilling and boring, after which a plug should be fitted to it and the measurements checked.

For the next hole the plug is again placed in the chuck and a cut taken over it to true it and then measurements can be taken from this plug to the one in the hole already bored, and also from the side of the jig, if the holes are not to be in exact line, remembering, of course, that the diameter of the plug in the chuck has been reduced by truing.

Work requiring boring with the hortzontal spindle may be strapped to an angle plate and the holes located and bored in a similar manner.

Of course, if we all had attachments for our millers, like those described by C. L. Goodrich, on page 918, a great deal of time and trouble would be saved, but the most of us have to make the best of what we have.

Frankfort, N. Y. G. F. OLIVER.

Hydraulic Pump Bodies

In connection with the article published at page 461, Vol. 35, dealing with the test of a hydraulic pump body, a German reader raises the following question:

In making high-pressure hydraulic pumps, continual trouble is experienced with porous material. How is the process of using muriate of ammonia applied to overcome this trouble?

The above query was referred to the author of the article referred to, and his reply is appended herewith.

Castings that have a tendency to sweat or are slightly porous, may be made tight by treatment with muriate of ammonia, known as sal ammoniac and ammonium (NH_4Cl). The idea of the treatment is to rust the pores of the casting so that no water can seep through.

The mixture is prepared by adding one part of sal ammoniac to one part of sulphur. This is added to clean, fine, iron borings and then diluted with rain water.

Before introducing this mixture into the body be sure that all oil is removed, as this will prevent the rusting process. This may be done by washing with gasoline and then allowing it to evaporate. This washing is only necessary in cases of steel castings where a great deal of oil has been used.

The body is prepared as for test and the mixture introduced, filling it to the top. Then connect the air line to the body and keep under pressure of about 100 lb. over night. This will stop small leaks and porous cavities.

It is much easier to prevent porous castings than it is to stop the leaks. This can be accomplished by proper attention to the method of molding. Do not be afraid to use plenty of large risers. Plan to put either a riser or a chill on every place that has a tendency to be porous. This will work wonders in getting solid castings.

In the plant with which I am connected we plan to pour our bodies toward the end of the heat, as then the metal is tougher and closer. We often use 25 per cent. of steel scrap, besides a liberal amount of stove plate, which gives a very close metal. The analysis of our bodies is approximately:

Silicon	1.00 to 1.25%
Manganese (use ferro-manganese)	1.00% or over
Phosphorus	0.50%
Sulphur	1.20 to 1.30%

H. C. WIGHT.

Dayton, O.

Standardization of Machine Tools

The subject of "Standardization of Machine Tools," page 725, is one of the most interesting topics that has appeared in some time, and I hope some of the machine-tool builders will let us hear about their view of the subject.

As a user of a large variety of machines, and having to put up with the usual inconvenience of their lack of interchangeability, the idea of there ever being the least degree of interchangeability among them seems like a beautiful dream—a dream that makes me wish that I might live a few generations hence instead of at the present time. I cannot imagine anything that could possibly go farther toward preserving the patience and good temper of the average shop foreman than to have all of his lathe chucks, centers, taper arbors, etc., interchangeable.

But to expect all these things to happen within the next fifty years would be expecting too much. The movement should have been started before the motor-car factories had put in so much equipment. If, however, the whole country would adopt a universal or standard taper, as, for instance, the "Jarno," it would make a great forward step toward uniformity in machine tools.

No doubt these changes are difficult to inaugurate, and it is useless to expect one firm to take the step alone. So why cannot a few of the big ones get together and make a start in the right direction? Surely "there is no time like the present," and the longer it is put off, the smaller grow the chances of anything ever being done.

LLOYD F. BLUNDEN.

Racine, Wis.

[We believe that the realization of machine-tool standardization is not as far in the future as our contributor imagines. —EDITOR.]

The first consignment of ferronickel made in New Caledonia has been received in France. It was made by the Société de Tao in the electric furnace. The alloy contains about 60 per cent. iron and 40 per cent. nickel, with 1 per cent. carbon and a trace of silicon, but no sulphur nor phosphorus.

A Round File Testing Machine

By C. B. Hess*

An interesting machine, developed by a manufacturer to test the product of file-cutting machines of his own make, with a view to the improvement of these machines.

*Hess Machine Works, Philadelphia, Penn.

While developing a file-cutting machine for cutting spiral-cut round files up to 8 in. in length, a file-testing machine was built to test the product before placing the cutting machine on the market.

The file-testing machine was constructed to give the files a test as near the actual service conditions as possible and arranged so that the results could be easily compared, special consideration being given to the point of the file.

A portable vise was placed on the platform of an accurate pair of scales provided with an Acorn automatic weighing attachment as shown in Fig. 1.

Various metals were successively placed in the vise and six machinists of different degrees of skill were given a 4-, 6-, and 8-inch round file with a specified task to perform with each.

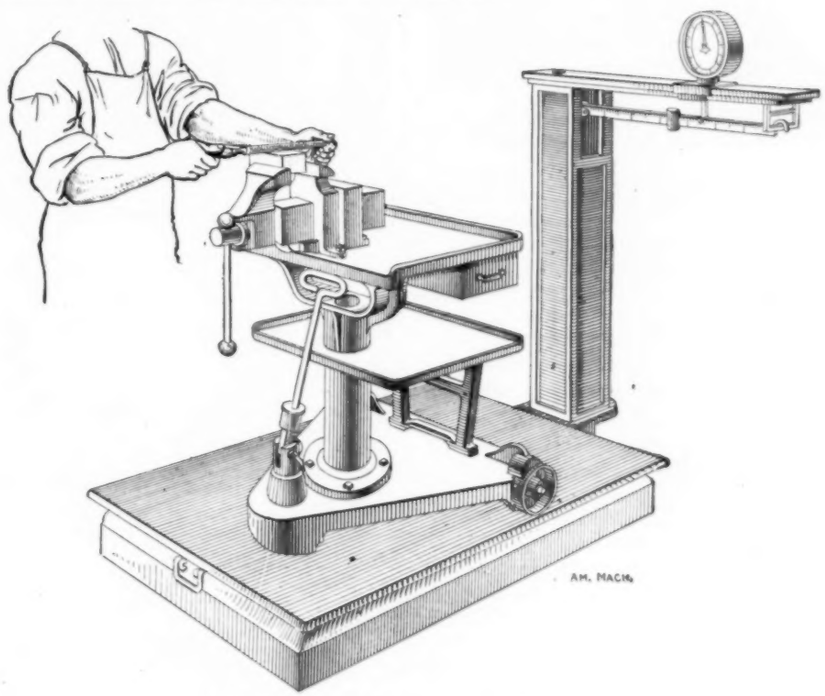


FIG. 1. HAND FILE-TESTING DEVICE

The speed with which each machinist filed, the pressure he exerted on the forward and return stroke, length of stroke and the manner in which he filed was observed.

The average results are given in the table, Fig. 2. This formed the basis for the specifications of the file-testing machine.

Figs. 3 and 4 explain clearly the principle and construction of the machine, which consists of a base, with a driving shaft having tight and loose pulleys on one end and a disk crank on the other end. On this shaft the guides for the crosshead are pivoted. They can be raised or lowered by adjusting the screw *A*, Fig. 3. The crosshead is connected to the connecting rod through a rod *B*, allowing the position of the stroke to be moved.

Under the crosshead is fastened a bracket which can be adjusted through a small vertical angle. This bracket *C* is set at an angle and through it is a hollow shaft, on one end of which is screwed a ½-in. Oneida drill chuck, which holds the file while being tested. On the other end is a ratchet with 16 teeth and a lever *E*, which turns the file $\frac{1}{16}$ of a revolution each return stroke.

The bracket *F*, Fig. 4, is fastened on the front of the machine and through this passes the test bar.

On the driving shaft is a one to two gear which drives a six-pitch worm on a 96-tooth worm wheel. The shaft *G*, Fig. 3, extends out from the worm wheel and is again geared down through 12.5 to 1 V-groove wood pulleys to a ¼-in. shaft threaded 13 threads per inch. A half nut on this thread moves the pencil over the indicating drum at the rate of 1 in. on the card for every 31,250 strokes of the file. The card being 10 in. high gives a capacity of 312,500 strokes per card.

The turning motion is given to the drum through the belt *H*, Fig. 4, fastened at the end of the test bar and running over a pulley on the drum shaft and down to the set of weights which holds the test bar against the file. This turning motion records the cubic inches of metal filed. Round machine steel or pin rod of $\frac{7}{16}$-in. diameter of known chemical analysis was finally adopted for test rods, and as it takes 13 in. of $\frac{7}{16}$-in. round steel to make 1 cu.in. and the circumference of the drum is 13 in., the capacity of the card is one cubic inch.

The test bar has a slow turning motion during the tests of one turn to 50 cutting strokes of the file, obtained by a belt driven from the shaft *G*, Fig. 3, over an idler pulley to a small pulley fastened on the end of the test bar, see Fig. 4. This turning motion keeps the end of the test bar square and reduces the friction of the vertical motion of the test bar through the bracket *F*.

The machine was run at 150 r.p.m., the stroke on all cards submitted was 1½ in. on the extreme end of the file and the weights were varied according to the table.

THE TEST BAR.

The first test bars put in the machine were turned annealed cast iron ¼-in. diameter and 18 in. long. It was found that the files cut these test bars away in 4 to 8 hours, and the tests were of undue length.

Workman	4-INCH ROUND FILE			6-INCH ROUND FILE			8-INCH ROUND FILE		
	Pressure	Strokes	Release	Pressure	Stroke	Return	Pressure	Stroke	Return
H. R.	3 lb.	200	No.	5	189	No.	9	101	Slight
J. R.	2¾	198	No	4¼	186	No	7	87	Slight
T. B.	3½	190	No	4	185	Slight	8¼	90	Slight
L. H.	2¾	200	No	3¼	190	No	6	104	No
D. K.	3	173	No	5	178	No	10	85	Slight
R. F.	3½	180	No	4½	175	No	7½	106	Slight
Averages	3	190	No	4.3	184	No	8	97	

FIG. 2. TESTS MADE WITH VARIOUS MEN USING FILES 4, 6 AND 8 INCHES LONG.

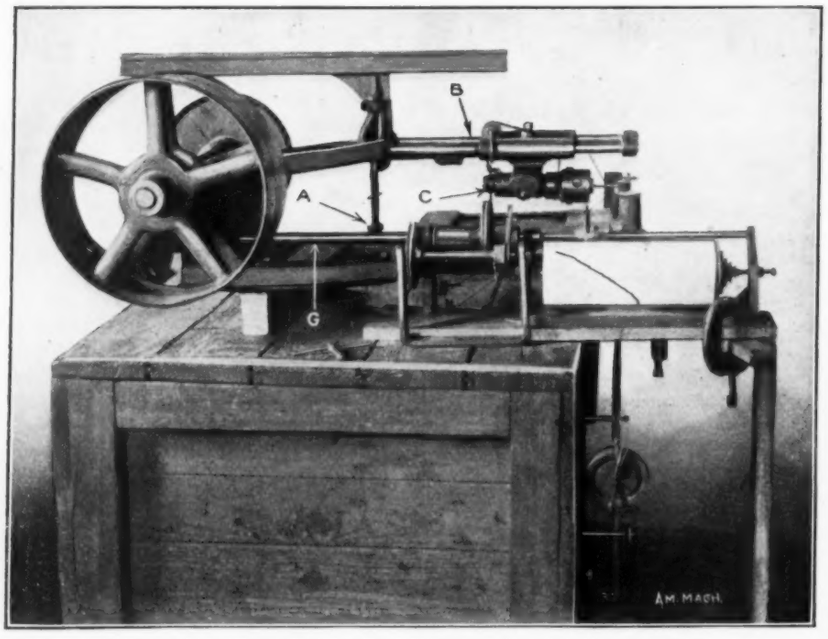


FIG. 3. SIDE ELEVATION OF FILE-TESTING MACHINE

The test bar was then increased to $\frac{5}{16}$-in. diameter with the same objections. The material was then changed from cast iron to machine steel or pin rod $\frac{5}{16}$-in. diameter. The files held up well, the test rods lasted longer and the tests were shortened and gave good curves. For an experiment $\frac{5}{16}$-in. diameter drill rod was tried, but the files ceased cutting quickly under the pressures given in the table.

All American makes of files from 4 to 8 in. in length with spiral cut were tested on the point and on the body.

For better comparison, all the cards taken from this machine were redrawn to the scale of 100,000 strokes per inch of curve and 1 cu.in. of stock removed per 1 in. of ordinate of curve.

A test was made on a 5-in. spiral round-cut file, 30 teeth per inch for 1,000,000 strokes with a pressure of 8 lb., showing that if the pressure is great enough the file will cut or wear off the test bar until the teeth on the file are almost entirely worn off. In this test the teeth on the file had their cutting edges worn bright, but the shape of the teeth was not altered to any great extent. This file cut $5\frac{7}{8}$ cubic inches.

Fig. 5 shows six cards taken from the extreme points of files on this testing machine. Test No. 7 is the test mentioned above, and is of no value as comparing the qualities of the file according to the table. Tests Nos. 9, 12, 18 and 27 are typical cards from the points of spiral round-cut files. Test No. 29 is of a 4-in. file cut on the Hess machine and tested in accordance with the table, has the highest rate of cutting recorded on the cards.

THE FILE-CUTTING MACHINE.

The chisel strikes the file blank at the same angle with relation to the surface, from the extreme point to the tang of the file, automatically. On a machine without this feature, in cutting a slim taper file, if the chisel is set at an angle of $12\frac{1}{2}$ deg. to the surface of the body, when it cuts the point it will strike the blank at a more obtuse angle, consequently forming improper teeth.

The blow of the chisel on the extreme point must be lighter than on the body. If the blow is lighter with the same spacing, blank spaces are left between the teeth. This machine is provided with an increment feed which, for example, on a 4-in. file starts to cut at the rate of 55 teeth per inch and decreases with the diameter of the file and the increased weight of the blow of the chisel, until the body of the file is reached, when it cuts at the rate of 40 teeth per inch, thus cutting more teeth in the point of the file than one cut without the increment feed. The value of this is seen in the test curve No. 29. On this machine the teeth are cut at the rate of 1800 per minute, the blow of the chisel being regulated by the operator from the point until the body of the file is reached, then remaining constant.

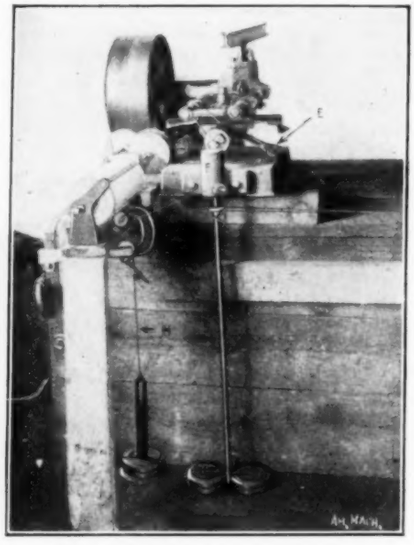


FIG. 4. END ELEVATION OF MACHINE

If small files of these sizes and shapes are bought on the basis of tests of this character (which they eventually will be), there will have to be two tests made of each file, one on the point and one on the body, because a small round file is seldom used to take a stroke its entire length as is a large flat file. The mechanic, if he holds the handle in one hand and the point in the other, only uses the body of the file to cut with, while, when he holds the handle and body, he only uses the point to cut with.

Square files are tested on this machine by disconnecting the ratchet which turns the files. All the tests shown in this article were made on files of ordinary file steel.

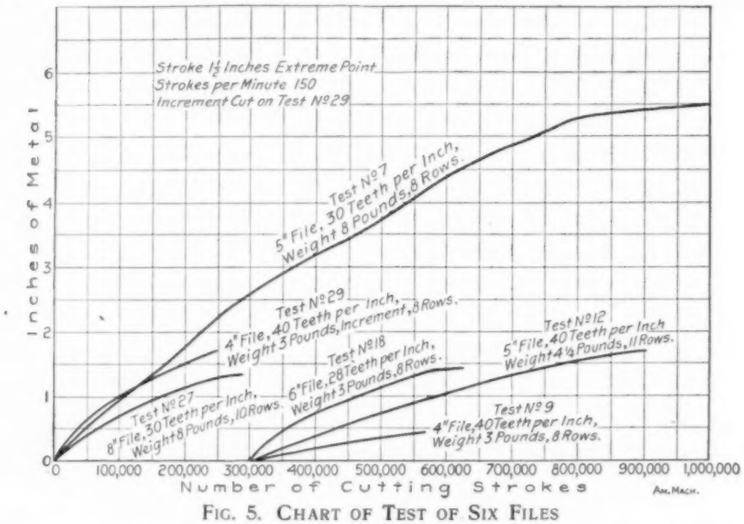


FIG. 5. CHART OF TEST OF SIX FILES

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OUTLINE OF TOPICS, PAGE 129

A Feature of Postal Savings Banks

The advent of the postal savings bank has developed a use which was probably little dreamed of by its originators. Planned as a means of inducing small savings with assured security, it is being used by business houses in some quarters in an entirely different way.

Builders of all kinds of machinery remember all too clearly, the difficulty of securing currency for their payrolls in the fall of 1907. This was because currency was withdrawn from the different localities and shipped to the home offices of some of the large corporations for use in financial coups at a later date.

Remembering this, machine builders and others in various quarters, have made substantial deposits in the postal savings banks to provide for just such an emergency. For, while the regular banks can refuse currency or parcel it out in limited amounts at their pleasure, the postal bank will at all times pay it in full on demand.

The effect of this should make an impression on such banks as seem to forget that they are simply dealers in currency, the same as a man may deal in shoes or machines, and that coöperation with manufacturers is better in every way than antagonism.

American Machinist

Efficiency and Ideals

It often happens that the methods which make for greater efficiency and hence, perhaps, for human progress, are so diametrically opposed to prevailing ideals, that their immediate adoption is delayed and the methods themselves are greatly modified before adoption on a large scale. This is necessarily so; for ideas are born instantly, while ideals are the growth of years and hence possess greater inertia. The modifying influence may come from those directly connected with the industry concerned, or it may come from the public which is being served. The influence of the latter has not been so noticeable in the past as it is at present, and without doubt it will be a more potent factor in the future.

Consider, for example, the manufacturing advantages which come with concentrated or combined ownership. Consolidation, in general, results in a reduction of costs because of the more efficient organization which it makes possible and the greater aggregate amount to be manufactured. But concentrated ownership when carried to the extreme would be fatal to our ideals of equal opportunity and free competition.

On the other hand, experience has shown us that unlimited opportunity and free competition are often extremely inefficient and costly when considered from the standpoint of the public at large. The tremendous amount of duplication of both plant and service under such a system can be seen by a casual examination of the methods by which the supplies of any town are distributed. There results not only an unnecessarily high cost but also a precarious and unstable state of existence for many of those engaged in traffic. The inefficiency and unnecessarily high cost resulting from several competing telephone, gas and electric systems is only too well known. The same may be well said of many other features of our industrial organization. We, as a nation, are even now wrestling with this problem, in an endeavor to obtain some of the benefits of these economic principles without sacrificing too many of our ideals; and the resulting compromises which have already been effected are worthy of careful study by all, but especially by those who have to do with industrial organization.

For these same general ideas apply to the methods for increasing industrial efficiency which are now being advocated so strongly. Undoubtedly, these methods make for greater efficiency of production; but there is a well grounded fear in many quarters that this gain will be accomplished only at the expense of the loss of personal initiative on the part of the workman. The question which is thus raised is an important one, for, aside from the humanistic aspect, the greatest asset which any industry can possess is intelligent creative workmen. Anything which tends to lower these characterictics is harmful personally to the workman, and runious to the industry.

The case is analogous to that quoted above and to many other similar movements. Experience has already shown us that we cannot depend on the iniative of the workmen alone and the growth of organization based on and making use of recorded results has been constant and tends rapidly to increase. But the successful extension of the principles which lie at the bottom of these methods; namely, subdivision of labor and the use of accumulated data, will depend much upon the relative value which we place upon personal development, as compared with the increased efficiency of production which these methods promise.

We shall, no doubt, do considerable experimenting, but there will be no permanent sudden change in administrative methods. Permanent change will come only after a careful weighing of possible gains on the one hand, and ideals of personality on the other. The result will be a compromise containing as far as possible the good elements of both.

The Futility of Technical Schools

R. T. Crane, of Chicago, has sent forth another of his contributions on the subject of higher education. This time the engineering schools are raked over the coals, under the title "Futility of Technical Schools."

His general contention is that the technical schools of this country are giving a training, which is of no practical value. We have used these columns before to present our say in regard to some of Mr. Crane's views on education. At this time we can do nothing better than to quote two paragraphs from a statement of Prof. W. W. Bird, of the Worcester Polytechnic Institute, printed in the weekly institute paper of Dec. 6.

"Everybody is born with some advantage or personality, and in the use of his advantage his success in life is measured, and success to Mr. Crane means money. If, then, a boy with either great engineer-

ing skill or executive ability starts out in life with a determination to use this advantage for his own personal ends, even if this be to the disadvantage of his fellow men, he will probably succeed in getting rich, and be a success without a technical education. Mr. Crane is a striking example of this type of man.

"No, Mr. Crane, technical schools do not turn out practical men from your point of view. You were born, not made. Technical schools do not make brains; they train them. They offer an opportunity for a young man of moderate ability to gain as much as possible from the experience of others and be prepared to defend himself so far as may be from the selfishness of 'practical' men. To the young man with special ability the schools offer an opportunity for development. While the education will not make him more 'practical,' it may make him a better 'practical' man."

This at once gives us the issue: Shall a young man devote himself to practical selfishness, or to getting a broad development, which will make him a benefit to himself and to others around him?

The closing paragraph of the article referred to asks us to consider these words of Justice Hughes, of the Supreme bench: "The first purpose of education in free society is not to furnish equipment for strife, or to sharpen the swords of selfish warfare, but to secure the benefits of peace and the enlightened coöperation of those whose equal opportunity is made to serve the prosperity of all."

The Cost of Repairs

It was probably quite natural in the days when business was considered as a one-sided transaction, in which one party simply had to be the loser, to make the prices for repair parts as high as the alleged conscience would allow, because the user of a machine had to have them. This practice was almost universal some years ago, many keen (?) salesmen of the older type boasting of making prices of a machine or locomotive very low and then making it up on repairs.

But this does not conform with modern business ideas, even if makers of agricultural machinery still adhere to it. Automobile builders have been guilty of the same practice, although there are a few notable exceptions, but it is not a winning policy in the long run in any case.

There are two reasons for this. In the first place every man resents being imposed on, and secondly, the best recommendation a machine can have is to be able to keep at work at a minimum expense for maintenance. When a man finds that repairs are heavy on a certain make of machine he is very apt to make a mental note of the machine he will *not* buy the next time. And the manufacturer who follows this plan in any line which is not as thoroughly controlled as the agricultural machinery, already referred to, is pretty sure to lose out in the long run.

We know of no more striking example of this than is brought out in connection with much of the repair work being done in the canal zone as pointed out elsewhere. Thousands of dollars worth of repair parts would have been bought of the manufacturers if they could have been secured at a price even as low as they could be made under such conditions as exist in such a place. But when patterns and castings can be made and a few pieces machined in what is practically a job shop, for far less money than the makers will sell for, no other course is open except to do the work yourself.

We are confident that the old idea is changing and for the better. Progressive manufacturers do not forget the customer or the machine after it is sold, but are interested in its continuous economy.

No one expects repair parts to be supplied at a loss, or that all costs of manufacture, storage, interest on investment, etc., will not be added to the cost of labor and material, as they should. But the policy of charging so much for an automobile cylinder, for example, that the owner had a pattern made and a single cylinder machined for less money, as one instance we know, can hardly be called enlightened business at this time.

Making Millions of Electric Meters

In the article under this heading, at page 1153, mention of the Lynn plant of the General Electric Co., where the material for the article was gathered, was inadvertently omitted. Thanks are hereby extended for the courtesy and cooperation of the officials of the meter department of the plant.

Machine Tool Builders Report

The official report of the tenth annual convention of the National Machine Tool Builders Association, which was held in New York on Oct. 10 and 11, 1911, has been received. Those who attended the convention do not need to be told of the interesting papers and discussion it contains; those who did not, will do well to read it carefully. It is printed on a light soft paper which makes it easy to read and light to handle.

January Meeting of A. S. M. E.

The Jan. 9 meeting of the New York members of the American Society of Mechanical Engineers promises to be of special interest. The outline furnished by the committee indicates an increase of live interest in the activities of the society in and around New York.

The speakers include President Humphreys, Prof. C. E. Lucke, F. A. Waldron, R. M. Dixon, G. J. Foran, F. R. Low, Leonard Waldo and E. Van Winkle, in addition to the opening by the local chairman, Prof. Rautenstrauch.

Locomotive Building Industry

A preliminary statement of the general results of the thirteenth census relative to establishments engaged in the manufacture of locomotives, except those made by railroad companies, shows there were 16 establishments engaged in this industry in 1909 and 15 in 1904, an increase of 7 per cent. The capital invested as reported in 1909 was $52,060,000, a gain of $13,639,000, or 35 per cent. over $38,421,000 in 1904. The average capital per establishment was approximately $3,254,000 in 1909 and $2,561,000 in 1904. The value of products was $31,582,000 in 1909 and $59,552,000 in 1904, a decrease of $27,970,000, or 47 per cent. The average per establishment was approximately $1,974,000 in 1909 and $3,970,000 in 1904. The value added by manufacture was $16,522,000 in 1909 and $31,849,000 in 1904, a decrease of $15,327,000, or 48 per cent. This item formed 52 per cent. of the total value of products in 1909 and 53 per cent. in 1904. The value added by manufacture represents the difference between the cost of materials used and the value of products after the manufacturing processes have been expended upon them. It is the best measure of the relative importance of industries.

Personals

James A. Carr, Richmond, Ind., has succeeded E. L. Buchwalter as president of the American Seeding Machine Co., Springfield, Ohio.

Allen Hudson, who was formerly foreman of the crusher department of the Allis-Chalmers Reliance works, has established a machine-shop repair business in Milwaukee.

J. M. Studebaker, Sr., has retired from the presidency of the Studebaker Corporation of America, and Fred S. Fish has been elected to succeed him. Mr. Studebaker will serve as chairman of the board of directors of the company.

E. L. Messler, who has been general superintendent for the past 12 years of the Jones & Laughlin Steel Co.'s Pittsburg coke ovens and blast furnaces, has resigned in order to become associated with the Riter-Conley Manufacturing Co., Pittsburg, where he will act in the capacity of assistant to the president.

Shop Equipment News

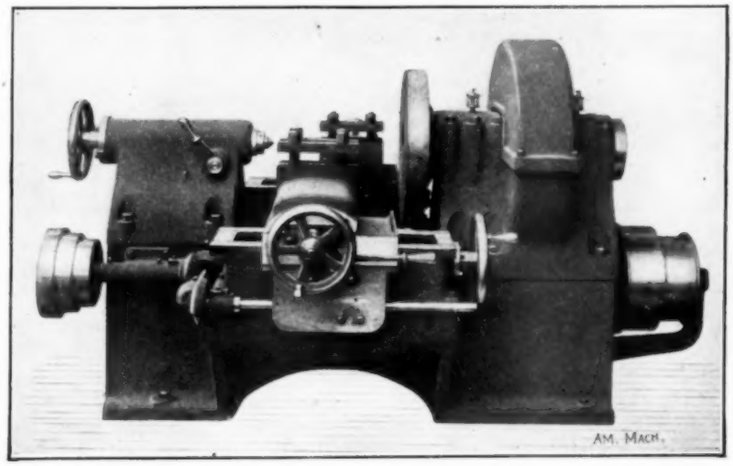
New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

Gear Turning Lathe

The accompanying halftone shows a 32-in. gear turning lathe designed especially for finishing steel gears, which adapts it to cast-iron work at increased speeds and feeds.

The rails are mounted on both sides of the bed, each of which carries independent tool slides. The tool slide on one side of the machine is provided with longitudinal food, while the tool slide on the opposite rail is provided with power cross feed. In this way three cuts are taken simultaneously.

The spindle is made of hardened crucible steel 7 in. in diameter, bored its entire length, and has four speeds ranging from 9 to 16.5 r.p.m., obtained by means of a two-speed countershaft and a two-step cone pulley. The ratio of gearing from the cone pulley to the spindle is 26 to 1. The spindle gear is 4-in. face, 4-pitch, of steel, and entirely inclosed. Pinions and all feed gears are of steel. All worms and worm wheels operating the feeding mechanism are entirely incased.



GEAR-TURNING LATHE

The machine is a recent design of the Cincinnati Pulley Machinery Co., Cincinnati, Ohio.

Horizontal Broacher

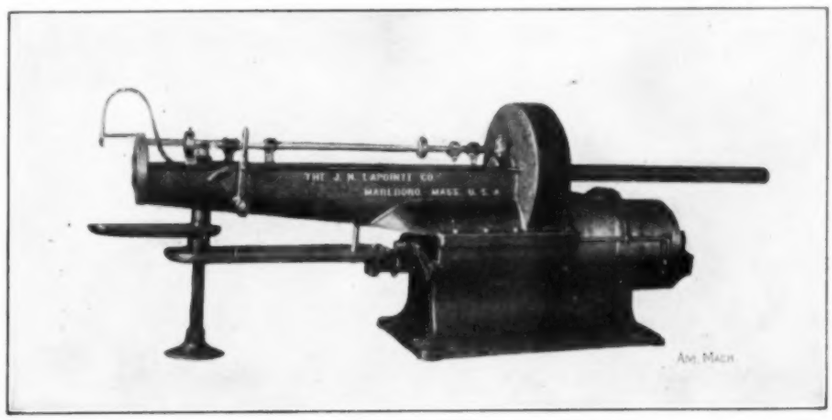
The accompanying halftone shows a broacher recently developed by the J. N. Lapointe Co., Marlboro, Mass.

The pulling mechanism consists of a sliding head pulled by a 2¾-in. screw passing through the hub of the main gear in which a special composition nut is inserted in such a way that it can be instantly removed for replacement. In order to overcome the friction when the load is applied, a large ball-bearing thrust is placed to receive the pressure, and at the same time the pulling capacity of the machine is increased.

The machine is arranged with two speeds, the change being accomplished by a sliding gear connected direct to the driving gears. The machine has a positive geared drive and return. The driving mechanism is of a type similar to a planer having two loose and one tight pulleys. In order to protect the screw from any dust accumulated by the belts, a large tube is screwed on to the rear end of the machine in which the screw telescopes.

Under the front end of the machine are two lugs, to which a special supporting table can be fastened by means of screws.

The machine is provided with automatic oil pump for flooding the work when being broached, and is also furnished with countershaft.



HORIZONTAL BROACHER

Universal Tool Holder

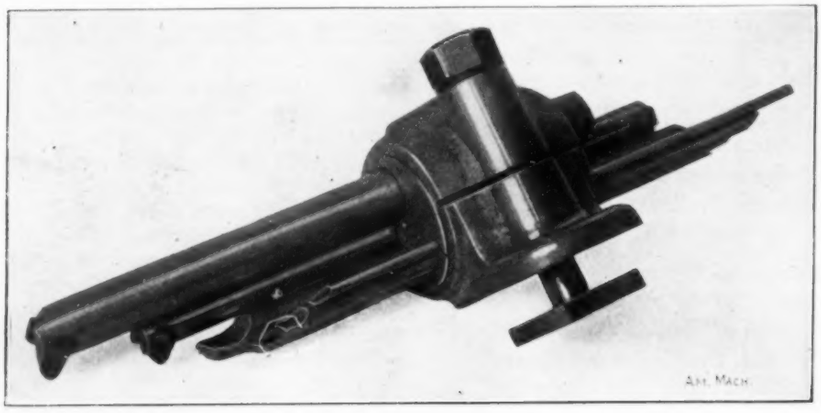
Ernest Stoecklin, Ridgefield Park, N. J., is manufacturing the tool holder shown in the accompanying halftone.

The holder is so made that it will fit any lathe; may be swung to any angle; any one of the six tools may be set at the proper height by shifting the tool block, and right- or left-hand cuts can be easily made.

The large bars with inserted cutters are 1x12 and ¾x12 in., and are made to hold cutters in each end, while the smaller tools are made of drill rod ⅝, ½, ⅜ and ¼ in. in diameter, respectively, and all 12 in. long, and are also double-ended, making 12 available tools altogether.

The tool block is, of course, split, and the webs between the holes for the tools are cut through, so that the tools are eas-

ily and solidly clamped, yet there is spring enough to prevent any disagreeable sticking. The tool block also has a circular groove entirely around the middle, into which the clamping bolt fits and prevents it from slipping out of the clamp.



UNIVERSAL TOOL HOLDER

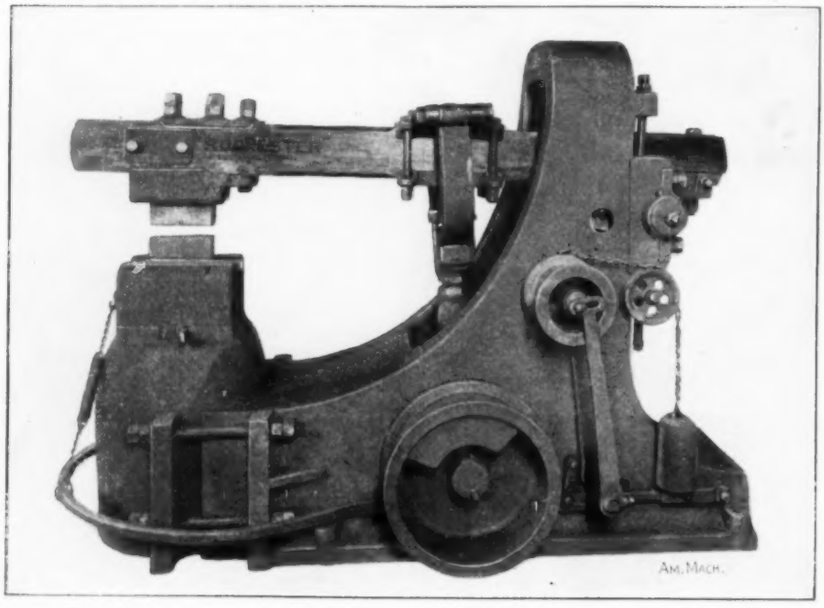
Helve Hammer

The accompanying halftone shows a helve hammer, recently developed by the West Tire Setter Co., Rochester, N. Y.

The frame is a solid gray-iron casting with solid babbitted shaft boxes of large dimensions, the anvil being separated from the frame by wood segments, designed to absorb the shock.

The boxes which support the helve pivot at the rear end of the helve have a vertical adjustment of 5 in., which, in connection with the adjustment of the connecting rod, makes this hammer adaptable to a wide range of work. The helve is of hickory and the spring and connecting toggles of such design that a cushion is obtained.

The anvil is in two parts, keyed together, allowing for adjustment or removal of top part, if required, and is heavy enough to give proper resistance to the blow. This type has been designed especially for manufacturing purposes, and is made in 60-, 80- and 100-lb. sizes, the latter weighing 4000 pounds.

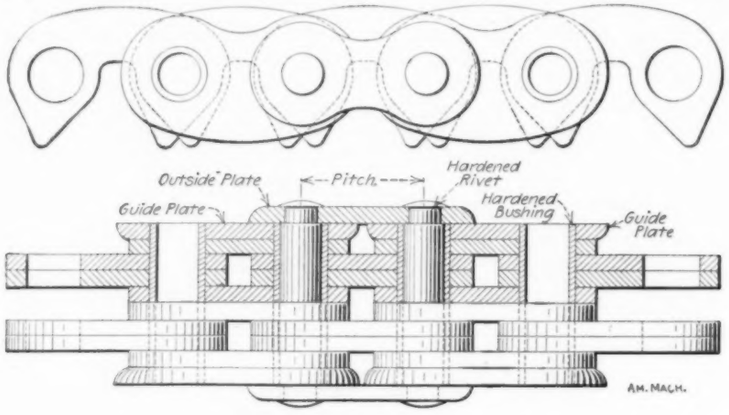


HELVE HAMMER

Silent Driving Chain

The construction of the silent type of chain, shown in the accompanying drawing, is such that the sprocket wheels used in connection with it need not be flanged or grooved, thus gaining the entire width for wear. This is accomplished by means of guide plates, which are a part of the chain. The guide plates are connected by outside plates, which give added tensile strength. The links are so assembled that each joint has four wearing surfaces. Hardened-steel bushings are forced into the guide plates by machinery so that they are held fast and cannot turn.

The steel links turn about the outside of the hardened-steel bushings, and the hardened-steel rivets, which are also forced into the outside plates, turn within the hardened-steel bushings.



SILENT DRIVING CHAIN

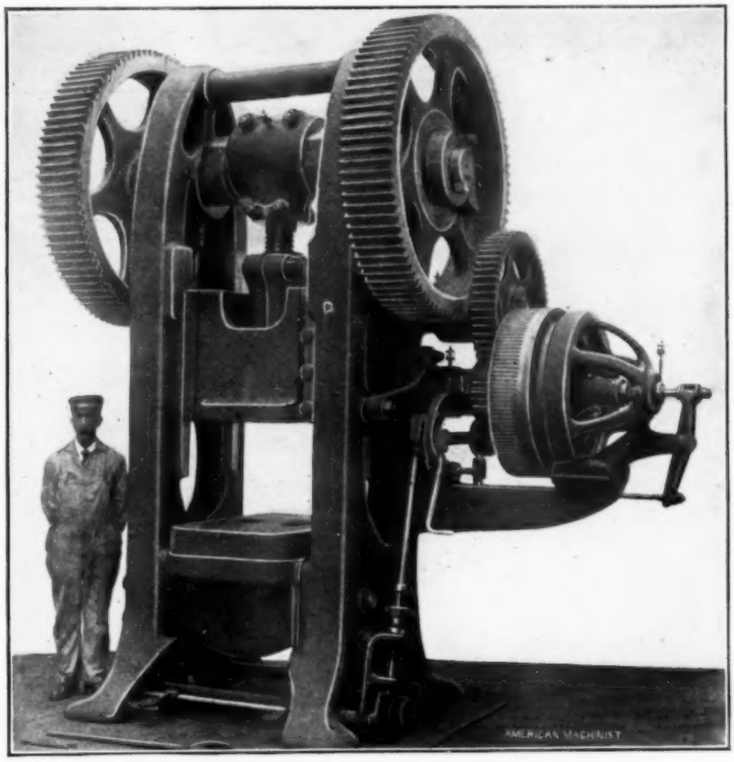
These chains are made in various sizes, 3/8, 1/2, 5/8, 3/4 and 1-in. pitch, by the Whitney Manufacturing Co., Hartford, Conn., and have a wide range of application.

Friction Clutch for Heavy Press

The press shown herewith is a regular type, made by the Ferracute Machine Co., Bridgeton, N. J., calculated for pressures up to 200 tons, and fitted with a new form of friction clutch.

The clutch mechanism is mounted on a bracket affixed to the side of the press, which enables the position of the press to be changed at any time without resetting and realigning the clutch. This construction also makes the clutch a unit with its bracket, which can be attached to various machines without altering its

design by simply bolting to the tablet on the side of the machine. The brake-spider is a part of the bracket itself, and is a separate piece, but the face or seat to which it is bolted is cylindrical, the axis of the cylinder being the axis of the clutch shaft, thereby securing alignment.



HEAVY PRESS WITH IMPROVED FRICTION CLUTCH

The clutch is relieved and the braking done direct without introducing additional mechanism. This effect is produced by the clutch-disk, a horizontally moving double cone located between the brake-spider and the flywheel. Affixed to the front and back rims of the clutch-disk are wooden sectors or blocks, the outer faces of the blocks bearing against corresponding surfaces on the inside rim of the flywheel and clutch-spider. The blocks are adjustable radially by means of blockscrews, the screws being locked by locknuts. The blocks are affixed to the clutch-disk by carriage-bolts. The simple moving of the clutch-disk in one direction or the other produces the clutching or braking action as desired, the clutch-disk carrying both the clutch and brake frictional surfaces.

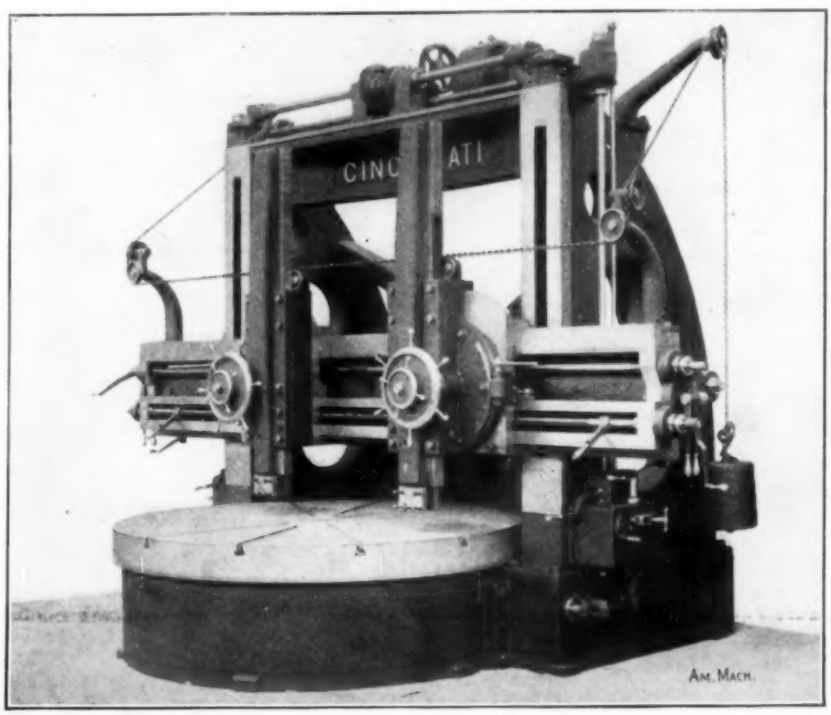
This design includes a treadle that can be caused to act in any position; that is, it is not necessary that it be in a vertical position. It also permits the clutch to be affixed to the machine at various heights by merely lengthening or shortening the treadle-rod.

Cincinnati Boring Mill

The accompanying halftone shows an 8-ft. boring mill, recently developed by the Cincinnati Planer Co., Cincinnati, Ohio.

The bed is a deep box form throughout, all parts are ribbed and braced and the entire mechanism of the mill is supported on the bed without any outside foundation. The table is the full diameter of the mill, and is supported on an automatically lubricated flat annular bearing of large diameter. The main driving gear is an internal gear cut from the solid, and the crossrail is of box form with a deep arch on the back, designed to reduce deflection to the minimum. The heads have narrow guide bearings at the bottom of the rail, and have power rapid traverse, and hand adjustment through crank handles on the end of the rail. There are 8 different feeds provided, ranging from $\frac{1}{32}$ to 1 in., instantly controlled by means of the lever at the side of the housing, where the feed box is located. A separate feed box is attached to each housing, giving independent feed for each head in all directions.

For motor drive a 2 to 1 variable-speed motor is used in connection with a speed box, giving four mechanical changes, while for belted drive a four-cone pulley is mounted on the top of the speed box, giving 16 changes of speed.



CINCINNATI 8-FT. BORING MILL

In the *Brass World* it is pointed out that the addition of a small amount of tin to sterling silver will harden it so that it is possible to produce a stiff and resilient sheet metal or wire by its employment. At one time it was proposed to use such an alloy for the manufacture of sterling-silver forks, but it did not become prevalent on account of the difficulty of keeping the scrap, resulting from the manufacture, separate from ordinary sterling silver.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

Metal Working

NEW ENGLAND

John N. Easland, Great Barrington, Mass., will install new machinery in his garage.

Eugene Giroux has taken out a permit to erect a blacksmith shop on Mill St., Springfield, Mass.

The main building of the Millbury (Mass.) Machine Co. was destroyed by fire. Loss, $6000.

The Boston Pressed Metal Co., Worcester, Mass., is building an addition to its plant, at 171-173 Union St.

The Frenier Automobile Co., Rutland, Vt., is building an addition to its plant on Cleveland Ave., to be used as a repair shop.

Scofield, Melcher & Schofield, jewelry manufacturers, North Attleboro, Mass., will remove their plant to Plainville, Mass.

The Sun Enamel Works, Leominster, Mass., is having two large additions erected in connection with its present plant.

The Bay State Brass Co., Haydenville, Mass., will make additions and improvements to its plant, which will double its output.

C. G. Perkins, manufacturer of electrical switches and appliances, Hartford, Conn., will erect a four-story factory building, at 83 Woodbine St.

James V. Critchley, Worcester, Mass., screw manufacturer, will shortly remove to the new plant, on Armory St. Considerable new machinery will be installed.

The United Manufacturing & Sales Co., Unionville, Conn., manufacturer of safety razors, will move its plant to Hartford, Conn., and contemplates enlarging.

The Maine Dental Supply Co. has been organized, at Portland, Me., for the manufacture of dental and surgical instruments. C. R. Andrews, president and treasurer, Westbrook, Me.

The Sturdy jewelry factory, at Chartley, Mass., was destroyed by fire. The plant was occupied by Engley & Goslin and Commings Co., manufacturers of jewelry. The loss to both firms amounts to $50,000.

A large jewelry-factory building is to be erected at Plainville, Mass. Judge E. J. Whitaker, of Wrentham, Mass., and Judge F. B. Byram and F. A. Howard, of North Attleboro, have charge of the arrangements.

The Morse-Readio Auto Co., Springfield, Mass., has incorporated with $150,000 capital, to conduct a garage and auto-truck salesrooms. A site has been secured on Dwight and Chestnut Sts., and a five-story garage will be erected.

MIDDLE STATES

The South Bend Watch Co., at South Bend, Ind., is erecting a three-story addition.

The International Steel & Iron Construction Co., Evansville, Ind., will enlarge its plant.

Wells & Adams, Rochester, N. Y., manufacturing aëronautical motors, will locate in Bath, N. Y.

The plant of the Troy (Ohio) Coöperative Foundry Co. was destroyed by fire. Loss, about $20,000.

A shop will be equipped with machine tools by Robt. Hillbrand, at 2339 Scranton Rd., Cleveland, Ohio.

The Pyott Foundry Co. will build a one-story foundry, at 310-14 North Sangamon St., Chicago, Ill.

The West Penn Steel Co. announces that it will erect three additional sheet mills at Brackenridge, Penn.

The Detroit Steel Products Co., of Detroit, Mich., manufacturer of automobile parts, is erecting a new factory.

The Michigan Stamping Co., of Detroit, Mich., maker of sheet-metal parts, is erecting an addition to its plant.

The plant of the White Steel Furniture Co., furniture manufacturer, at Grand Rapids, was destroyed by fire.

The Globe Machine & Stamping Co. will erect a factory building at 1244-54 West Seventy-fifth St., Cleveland, Ohio.

It is reported the Baldwin Locomotive Works, of Philadelphia, is considering the erection of a plant in Chicago.

The Wolverine Brass Works, Grand Rapids, Mich., will erect a new factory building and an addition to its foundry.

The machine shop and other buildings of the Empire Engineering Co., at Gasport, N. Y., were destroyed by fire. Loss, $17,000.

The United States Foil Co. will establish a plant at Yonkers, N. Y. R. H. B. Butler, 326 Riverdale Ave., Yonkers, is manager.

The Brown Brass Manufacturing Co., of Wappanee, Ind., has doubled its capital, and is in the market for additional equipment.

The plant of the Round Oak Stove Works, of Dowagiac, Mich., stove manufacturers, was partially destroyed by fire on Dec. 10.

Fire destroyed the large machine shops, etc., of the Delaware & Hudson R.R. Co., at Carbondale, Penn., causing a loss of $200,000.

The Fairweight Scale Co., of Danville, Ill., has purchased a site near Gary, Ind., for the immediate erection of a large scale factory.

The Anderson (Ind.) Meat Slicer Co. has been incorporated, to manufacture meat slicers, etc., by H. D. Webb, L. S. Webb and N. Baxter.

The Steel Button Manufacturing Co., 457 West Twenty-sixth St., New York, will move to Paterson, N. J., where a new plant will be erected.

The Emery Motor Co. will build a $10,000 garage, at 5200 Lake Ave., Chicago, and equip it with tools to do a general repair business.

Kelly Brass Works, Chicago, has been organized to do brass-foundry business. Incorporators, Patrick S. Kelly, Thos. F. Kelly. Capital, $20,000.

The Hayes Manufacturing Co., Detroit, Mich., manufacturing sheet-metal parts and drop forgings for automobiles, is erecting a new factory.

The Columbus, Ohio, plant of the Carnegie Steel Co., which has been idle for a year, will reopen about Jan. 1, and will make several improvements.

The Western Conduit & Manufacturing Co., of Chicago, has reorganized and will move its plant to Youngstown, Ohio. Will buy new machine tools.

The Hydraulic Pressed Steel Co., of Cleveland, Ohio, has just completed the erecting of its new plant, and will need machine-tool equipment.

A permit has been issued to the Ajax Forge Co., Chicago, to erect a shop. John M. Jones & Co., Chicago, will erect a two-story foundry to cost about $16,000.

The Elkhart Iron Works, Elkhart, Ind., has been incorporated, with a capital of $36,000, by W. H. Holland, E. J. Bennett and C. S. Workinger, to operate a foundry.

The Power Multiplex Tool Co., Detroit, Mich., has been organized, to manufacture special machinery. Capital, $20,000. Robert M. McKenzie, principal stockholder.

The Union Electric Welding Co., of Toledo, Ohio, has been incorporated, to do a general welding business, and will need necessary equipment. J. J. Urchel, incorporator.

The Down Trolley Supply Co., Toledo, has been incorporated, to manufacture all kinds of trolley supplies, by Z. T. Paulin, E. U. Down, W. E. Byers, etc. Capital, $20,000.

The Rochester (N. Y) Hook & Eye Co. has been incorporated to manufacture hooks and eyes. Capital, $40,000. Incorporators, H. Satterlee, H. D. Van Duser, J. S. Fitch.

The Brooks Co., Detroit, Mich., has been organized, to manufacture electric washing machines. Capital, $10,000. Incorporators, C. F. Murray, A. J. Walsh and C. H. Brooks.

The capital stock of the American Folding Machine Co., of Cleveland, has been increased from $100,000 to $125,000, to provide for improvements. Philip Monreal is president.

The Inman Manufacturing Co., Amsterdam, N. Y., has been organized to manufacture box machinery, etc. Capical, $300,000. Incorporators, H. Inman, C. H. Inman, R. A. Wood.

Illinois Gas Machine Sales Co., Rockford, Ill., has been incorporated to man-

ufacture automatic gas machines. Incorporators, Geo. W. Brown, Louis A. Johns. Capital, $15,000.

The Miami Iron & Steel Co., Hamilton, Ohio, has been incorporated, etc., to manufacture iron and steel, by E. M. Peters, H. L. Breneman, Louis A. Ireton, etc. Capital, $625,000.

The Atlas Specialty Manufacturing Co., Chicago, has been incorporated, to make metal specialties, etc., by Cæsar J. Woldham, John E. McAuley and Howard F. Leopold. Capital, $10,000.

The Sterling Typewriter Co., Newark, N. J., has been incorporated to manufacture typewriters. Capital, $1,000,000. Incorporators, Jerome T. Congleton, A. F. Slingerland, A. E. Perrins.

The Stark Auto Co., Canton, Ohio, has been organized with $20,000 capital to deal in automobiles and operate a repair shop by W. H. Burgener, Thomas C. Huth, Samuel Haenny, etc.

Fire in the Sanderson Steel Mill, West Fayette and Magnolia Sts., Syracuse, N. Y., caused $60,000 damage. The mixing room and pipe room suffered worst; the wire mill was damaged.

The Columbia Vehicle Co., Hamilton, Ohio, has been incorporated with $15,000 capital to manufacture and sell vehicles and parts by Geo. W. Platt, M. M. Dermody, Samuel Zielonka, etc.

The A. V. Manufacturing Co., carbureters, marine-engine parts and various automobile accessories, has awarded the contract for the erection of a factory at Poughkeepsie, N. Y.

It is rumored that the old plant of the Courier Motor Car Co., Dayton, Ohio, has been purchased by John W. Stoddard, for the purpose of engaging in the manufacture of a new automobile.

The High Level Auto Co., Ashtabula, Ohio, has been organized to buy and sell automobiles and operate a repair shop by J. C. Topper, Earl Gardner, T. P. Fitzgerald, etc. Capital, $10,000.

The Wolf Furnace Co., of Fort Wayne, Ind., has been incorporated, to manufacture furnaces for heating, and will need equipment. W. C. Wolf, M. W. Wolf and S. P. Saltsgiver are stockholders.

Thomas W. Warner, owner of the Warner Auto Parts Co., at Toledo, Ohio, is contemplating the erection of a large factory at Muncie, Ind. About 1000 men will be employed at the new plant.

The Famous Door Check Co., Chicago, has been organized, to manufacture liquid door checks and other specialties, by John C. Schmidt, Carroll L. Ethridge and Martha Schmidt. Capital, $6000.

The Safety Wire Gas Globe Co., of Columbus, Ohio, has been incorporated, to manufacture wire gas globes, and will need wire-forming and bending machinery. Thomas Hanna, incorporator.

The Thorp Iron Co., New York, has been incorporated to manufacture structural iron work. Capital, $30,000. Incorporators, A. H. Fischer, W. S. Thorp, New York; C. H. Parsons, Brooklyn.

The Stewart & Clarke Manufacturing Co. will build a one-story machine-shop as an addition to its present works, at 1829-45 Wolfram St., Chicago. This will call for an entire new outfit of tools.

The General Steel Products & Supply Co., Toledo, Ohio, has been organized to manufacture and sell structural steel by E. J. Marshall, John E. Parsons, Jr., Geo. E. Dixon, etc. Capital, $10,000.

The Shartle Brothers Machine Co., Middletown, Ohio, has been incorporated, to do a general machine business, by Charles W. Shartle, Lucy C. Shartle, H. D. Martindale, etc. Capital, $10,000.

The Potter Manufacturing Co., Geneva, Ohio, has been organized with $25,000 capital to manufacture garden tools and hardware by W. Arthur Potter, C. J. Chamberlin, A. M. Ford, etc.

The Prince Motor Car Co., Warrenville, Ohio, has been incorporated with $200,000 capital to manufacture and sell motor cars and parts by W. F. Kehres, Thomas J. Atkinson, John G. Schultz, etc.

The Royal Electric Co., Sidney, Ohio, has been organized, to manufacture all kinds of telephone, telegraph and electric equipment, by C. R. Bleakley, L. L. Layton, J. H. Thedeick, etc. Capital, $20,000.

The Koepke Motor Sales Co., Cleveland, has been organized, to deal in automobiles and operate a garage and repair shop, by John C. Koepke, Edmund C. Hasel, Emma Koepke, etc. Capital, $30,000.

The Hewitt Motor Co., New York, has been organized, to manufacture and deal in automobiles, etc. Capital, $1,000,000. Incorporators, Alden Ames, Robt. E. Henley and John O. Wingrave, all of 30 Pine St.

The Atlas Still Manufacturing Co., New York, has been incorporated, to manufacture stills, condensers, boilers, etc. Capital, $300,000. Incorporators, M. M. Kotzen, J. Lichtenstein and R. H. Raphael.

The Battenberg Car Seal and Equipment Co., Chicago, Ill., has been incorporated to manufacture car seals, locks, etc. Capital, $100,000. Incorporators, L. C. Weyland, Alex. Prussing and M. H. Battenberg.

The Detroit Switch Lock Co., of Detroit, Mich., has been incorporated, to manufacture railway appliances, and will need machine equipment. M. W. Edgar and J. B. Decker are the principal stockholders.

The Approved Ry. Appliance Co., New York, has been organized to manufacture railway supplies, etc. Capital, $10,000. Incorporators, A. V. R. Barnwall, Rye, N. Y.; Leonard W. Kent, 30 Church St., New York, etc.

The Stafford Heating & Sheet Metal Co., Conneaut, has been organized, to manufacture heating and plumbing materials and sheet-metal work, by F. F. Walton, W. R. Stafford, H. G. Kingdom, etc. Capital, $10,000.

The Brooks-Norton Motor Sales Co., Cleveland, Ohio, has been organized to deal in automobiles and operate a repair shop and garage. Incorporators, W. K. Stanley, J. W. Brooks, Chas. L. Norton, etc. Capital, $10,000.

The Julian Motor Co., of Syracuse, N. Y., has been incorporated, with $200,000 capital, to manufacture automobiles, trucks and motor boats. Will probably erect a building for a factory. Julian S. Brown is president.

The Sturdy Smokeless Furnace Co., Buffalo, N. Y., has been incorporated, to make furnaces and boilers. Capital, $100,000. Incorporators, J. Sturdy, F. A. Shoemaker, Buffalo, etc. Offices are at 21 Builders' Exchange.

The Excelsior Coupler & Tool Co., Newark, N. J., has been incorporated to manufacture car couplers, tools, etc. Capital, $50,000. Incorporators, Albert A. Moss, 53 Wallace St., W. C. Roszel, 164 Market St., Newark, etc.

The Never-Miss Manufacturing Co., Lansing, Mich., manufacturer of spark plugs and electrical goods, has sold its factory and equipment in that city and will move to Jackson, where a new factory is under construction.

The Tri-Prong Hair Pin Co., Camden, N. J., has been incorporated to manufacture hair pins, hooks and eyes, etc. Capital, $185,000. Incorporators, Louis C. Belz, Isaac Collins, John D. McMullin, all of 522 Market St., Camden.

Narowetz Heating & Ventilating Co., Chicago, Ill., has been incorporated for the purpose of manufacturing and installing heating and ventilating apparatus. Incorporators, Louis Narowetz, Gail E. Deming. Capital, $10,000.

The Omaha-Auburn Auto Co., of Auburn, Ind., has been incorporated, to deal in automobiles and conduct a general garage and repair business, and will need machine equipment. F. E. Eckhart and M. Eckhart are the incorporators.

The Empire Gear & Manufacturing Co., of Indianapolis, Ind., has been incorporated to manufacture automobile engines and transmissions. Machine equipment will be needed. Frank S. Clark, president; Wesley Haufler, general superintendent.

The Avenmarg & Carter Machine Co., Cleveland, Ohio, machinists and tool makers, has been incorporated, with $10,000 capital, to increase its machine-manufacturing capacity. Incorporators, Wm. A. Avenmarg, R. O. Carter, M. Koch and others.

The Kansas City-Auburn Auto Co., of Auburn, Ind., has been incorporated, to deal in automobiles and conduct a general garage business. Will need machine equipment for garage. C. Eckhart and F. E. Eckhart are among the stockholders.

The American Welded Chain & Ring Co., New Brunswick, N. J., has been organized, to manufacture welded wire chains, rings, castings, etc. Capital, $25,000. Incorporators, C. C. Thatcher, Jr., J. E. Alexander and Wm. E. Sperling, 133 Livingston Ave.

Reed & Morrill, Inc., Brooklyn, N. Y., has been organized, with $100,000 capital, to manufacture molding machinery, hoisting and excavating machinery, etc. Incorporators, H. P. Read, Brooklyn; M. D. Morrill, Conway, N. H.; H. A. St. George, New York.

The Briggs Detroiter Co., Detroit, Mich., recently incorporated to manufacture automobiles, has purchased a factory and will start business as soon as equipment can be obtained. Claude S. Briggs, E. D. Moesner and John A. Boyle, incorporators.

The main building of the Aetna-Standard mill of the American Sheet and Tinplate Co., at Bridgeport, Ohio, in which 1200 men work, has been condemned by the company as unsafe. It will be torn down at once, to be replaced by a new structure to cost $200,000.

The Western Conduit & Manufacturing Co., Chicago, recently reorganized, has increased its capital from $50,000 to $100,000. It will be moved to Youngstown, Ohio, where a new plant will be erected. The Youngstown Sheet & Tube Co. has a controlling interest.

The Parker Motor Wagon Co., New York, has been incorporated to manufacture and deal in motor vehicles, etc. Capital, $10,000. Incorporators, Drew McKenna, 453 West Forty-first St., Brooklyn, N. Y.; Chas. E. Wood, 605 West

One Hundred and Forty-seventh St., New York.

The Stuyvesant Motor Car Co., Cleveland, Ohio, has taken over the Grant-Lees Machine Co., and a new $350,000 corporation organized, to manufacture motor cars on a large scale. Ground has been broken for a new $65,000 plant, a garage and a fully equipped repair shop; $125,000 is to be spent in machinery of the latest type.

SOUTHERN STATES

The Danville (Fla.) Plow Works is considering the manufacture of stoves.

Construction of new shops for the Seaboard Air Line Ry., at Savannah, Ga., will begin shortly.

The Parkersburg, Marietta & Inter-Urban Ry. Co. will erect repair shops at its barns, in Marietta, Ga.

Nine stalls will be added to the roundhouse of the C. N. O. & T. P. Ry., at Ludlow, Ky. New machinery also will be purchased.

WEST OF THE MISSISSIPPI

The Ole Lundtvedt blacksmith shop was destroyed by fire at Oklee, Minn.

The Baker Valve Co., Minneapolis, Minn., is planning an enlargement of its plant.

J. H. Murr, North Bend, Ore., plans for the erection of a modern foundry plant at Florence, Ore.

J. Gioia, 801 North Broadway, Los Angeles, Calif., will build a new machine shop. A building permit has been issued.

Jeff Schelde, of Jamestown, N. D., will erect a machine shop and garage. Jno. Anderson will be in charge of the machine shop.

The American Forge Co., Mission St., San Francisco, Calif., has taken out a permit to build an addition to its manufacturing plant.

Mayo Thorndike, San Diego, Calif., will build a commercial garage and repair plant on Tenth St. Modern machinery will be installed.

Jno. B. Majerus is erecting a machine and blacksmith shop at Bellechester, Minn., to be occupied by H. Detthmers, of Castlewood, S. D.

Payne's Bolt Works, Howard St., San Francisco, Calif., has taken out a permit to build a new addition and make improvements in its plant.

The blacksmith shop of John Yore, Downieville, Calif., was destroyed by a landslide. The plant will be rebuilt and new equipment installed.

The plant of the Hoover Auxiliary Spring Co., Fell St., San Francisco, Calif., was totally destroyed by fire. It is said that the plant will be rebuilt.

Cretsinger Brothers, Los Angeles, Calif., have been granted permission by the City Harbor Commission to build a boat building and repair plant at Wilmington, Los Angeles Harbor.

The Blue Flame Distillate Burner Co., Los Angeles, Calif., has leased property on East Ninth St., and will establish a plant for the manufacture of gas burners for furnaces and stoves.

The Commercial Club, Salt Lake City, Utah, is interested in a plan to establish a plant for the manufacture of a patented dis' plow. Mr. Davis, inventor of the plow, is at the head of the project.

The Boston Automobile Supply Co., Los Angeles, Calif., has acquired property on South Olive St., and will establish a plant for the manufacture and repair of automobile tanks, drip pans and similar specialties.

The Arizona Eastern Railway Co., Tucson, Ariz., is having plans prepared for a new roundhouse, to be erected at Winkelman or Hayden, Ariz. This company is a subsidiary of the Southern Pacific R.R.

The Van Nuys (Calif.) Auto Garage Co. recently incorporated, will establish a modern commercial garage and repair plant. The plant will be fully equipped. F. H. Cyriacks and M. C. Frantz are at the head of the company.

D. Tower, Springfield, Ore., is at the head of a recently organized company, which will soon commence the erection of a plant, at Springfield, for the manufacture of a patented automobile truck. Modern machinery will be installed.

The Smith Spring Wheel Co., Albuquerque, N. M., has been incorporated, with a capital of $1,000,000, by C. G. Smith, Palisades, Calif., and H. M. Sykes, J. A. Root and Isaac Barth, of Albuquerque. Offices will be established at Albuquerque.

The Motor Distributing Co., Inc., Seattle, Wash., has been organized to represent the Lozier automobile. The company contemplates the erection of a large commercial garage and repair plant, and will soon select a site. T. A. Davies is president of the company.

The S. & R. Machine Co., Wenatchee, Wash., will establish a machine shop on Orondo Ave. A. W. Browning, who is interested in this company, also plans for the establishment of a plant at the same location for the manufacture of a patented spraying machine. Both plants will be fully equipped.

CANADA

C. S. Boone will equip a new garage and repair shops at Toronto.

The Norsworthy Furnace Co., of St. Thomas, will extend its plant.

The Canadian Locomotive Co. will double its plant at Kingston, Ont.

The Universal Motor Co. will locate a new plant at Fort William, Ont.

The Graydon-McCullough Co. will equip a new automobile plant in Toronto.

The Canadian Harrison Van Winkle Co. will equip a new foundry at Toronto.

The Dominion Bridge Co. will establish a plant at Calgary, Alberta, Can.

The St. John Ry. Co., of St. John, N. B., will equip a plant for manufacturing its own cars.

The Flanders Electric Vehicles Co., of Walkerville, Ont., will make extensions to its plant.

The Steel Products Co., of Morrisburg, will locate a large new factory at Port Arthur, Ont.

W. J. Lindsay, of Toronto, Ont., proposes to build a stove and furnace plant at Port Arthur, Ont.

The A. W. Parks & Sons Co., manufacturers of gasoline engines, at Peterboro, will extend its plant.

R. Watt is equipping a new machine works, at Ridgetown, Ont., and engines, threshers and separators will be manufactured.

GENERAL MANUFACTURING

NEW ENGLAND

Page Bros., Cambridge, Me., are erecting a large sawmill at that place.

The lumber mill of the Davidson Lumber Co., Summit, Me., was destroyed by fire.

Melrose, Mass., will issue $5000 bonds for the improvements to its water system.

The Massachusetts Masonic Home, at Charlton, Mass., will install an electric plant.

The Bay State Storage Warehouse Co., Lowell, Mass., will erect a large cold-storage plant.

William J. Mackay will erect a cold-storage and fruit-packing plant at Hampden, Mass.

West Acton, Mass., contemplates the installation of a new water system, to cost about $50,000.

The Hamilton Manufacturing Co., Lowell, Mass., is to build a large addition to its cloth room.

Fred J. Goff, North St., Grafton, Mass., is in the market for an automatic electric motor water pump.

The Seacoast Canning Co., Eastport, Me., will rebuild the fertilizer plant, recently destroyed by fire.

A common battery system is to be installed at the telephone exchange in Great Barrington, Mass.

The Globe Mills, Woonsocket, R. I., is to build a new picker plant in connection with its present factory.

The L. D. Bemis Coal Co., Spencer, Mass., will erect a new coal pocket on Elm St., of 600 tons capacity.

The East Haddam Electric Light Co., of East Haddam, Conn., will install a new dynamo at its plant at Leesville.

The West Boylston Co., manufacturer of cotton goods, will build an addition to its No. 2 mill, at Easthampton, Mass.

The George E. Duffy Manufacturing Co., woolen manufacturer, Worcester, Mass., will build an addition to its plant at 1511 Main St.

The Calais (Me.) Street Ry. Co. will erect a new power house, at Milltown, Me. The present power house is to be used as an auxiliary.

Fire destroyed the lumber plant of D. H. Curtis & Co., Stafford Springs, Conn. A boiler, engine and machinery were destroyed. Will be rebuilt.

The Boston Self-Locking Block Co., now located on Atlantic Ave., Boston, Mass., will move to Waltham, Mass. The concern makes hoisting-tackle blocks.

The Hall Piano Co., East Douglas, Mass., will install new boilers in its plant. A generator for connecting with the waterwheels will also be installed.

The Hoosac Worsted Co., North Adams, Mass., has purchased the old Johnson-Dunbar mills property and will equip same for the manufacture of woolens and worsteds.

The Clark Power Co. has filed articles of incorporation, at Biddeford, Me., for the purpose of generating and distributing electricity. Cecil F. Clark, president; Lucien F. Clark, treasurer.

The Maine Hydraulic Power Co., Bath, Me., has incorporated, to build a dam and power plant at Bath to supply electricity to adjacent territory. William S. Maxwell is at the head of the company.

Power-plant equipment and a vacuum-cleaning system will be required for the municipal office building to be erected on Main St., Hartford, Conn. Estimated cost, $300,000. Architects Davis & Brooks, Hartford, Conn.

The New England Corset Co., Worcester, Mass., which recently purchased the old loom factory on Green St., will build an addition to the same. A power plant will also be erected. J. P. Kingston, Knowles Building, Worcester, Mass., architect.

MIDDLE STATES

The Cole Motor Co., Indianapolis, Ind., will install a boiler.

The Trenton (N. J.) Power Co. has plans for a new power house.

The E. H. Moreton Truck Co., of Detroit, Mich., is erecting a factory.

Orange, N. J., will issue $13,000 bonds for improvements to its water system.

Blanchard Brothers' flour and cider mill, at Brooklyn, Mich., was destroyed by fire.

Akron, Ohio, will issue $160,000 bonds for improvements to its waterworks system.

Dayton, Ohio, will issue $31,500 bonds for improvements to its waterworks system.

Fire destroyed the plant of the New Jersey Adamant Manufacturing Co., East Newark, N. J.

Benton Harbor, Mich., will build a new pumping station for the municipal water-works.

Hudson Falls, N. Y., has voted to install a gravity water system, to cost about $175,000.

The plant of the Adjustable Table Factory, at Grand Rapids, Mich., was destroyed by fire.

The Egley-Doan Co. has begun the erection of a $35,000 grain elevator at Fort Wayne, Ind.

The New Lisbon (Ohio) Gas Co. has increased its capital to buy new gas-making equipment.

The Massachusetts Laundry Co., of Detroit, Mich., is erecting a new plant and will need equipment.

The American Malted Food Co., Milwaukee, Wis., is having plans drawn for a new $100,000 plant.

The Philadelphia Yarn Dyeing & Bleaching Co.'s plant, at Cleveland, Ohio, was destroyed by fire.

The Indiana Canning Co., Evansville, Ind., will start in a few weeks the erection of a new factory.

Plymouth, Wis., will issue $35,000 bonds for improvements to its water and electric-light systems.

The J. P. Beach Marble & Granite Co., Columbus, Ohio, will need some compressed-air machinery.

The Salamanca (N. Y.) Furniture Co. is building an addition, which will double the capacity of its plant.

Fire in the packing plant of Armour & Co., 406 Henderson St., Jersey City, N. J., caused a loss of $25,000.

The North Western Terra Cotta Co. will build a four-story mill at 2724-26 North Hermitage Ave., Chicago.

The White Mountain Creamery Co., of New Bremen, Ohio, will erect a $50,000 creamery plant, at Lima, next year.

The Vassar (Mich.) Milk Condensing Co. is erecting a new plant. Will need refrigerating and power equipment.

The Cleveland (Ohio) Electric Illuminating Co. will buy considerable power and other electric-light plant machinery.

The Fireproof Storage Co., Cleveland, Ohio, will build a $75,000 building. Power and heating plants will be needed.

The Paris Laundry Co. will build a two-story laundry, at 2336 Prairie Ave., Chicago, and fit it up with new equipment.

The Blaisdell Paper Pencil Co. has let contract for a one-story factory at Apsley St. and Wayne Ave., Philadelphia, Penn.

The Keller Knitting Co., Cleveland, Ohio, recently incorporated, will buy equipment for knitting factory. W. A. Keller.

The E. H. Benway Co., Corinth, N. Y., will rebuild its excelsior and furniture plants, recently burned, with a loss of $35,000.

The Creamery Package Co., of Detroit, Mich., box manufacturer for shipment of creamery products, is erecting a new factory.

The press mill of the E. I. du Pont de Nemours Powder Co., at Oriental Siding, near Oliphant, Penn., was destroyed by explosion.

The Edison Illuminating Co., of Detroit, Mich., has increased its capitalization and will spend $1,500,000 for improvements.

Cross Brothers, of Detroit, Mich., owners and operators of the Cross laundry, are to erect a new plant, and will need laundry equipment.

The Orinoco Furniture Co., of Columbus, Ind., has increased its capital and will need equipment for the extensions of manufacturing planned.

The Cleveland, Painesville & Eastern Ry. Co. will erect a power house at Painesville, Ohio. The building and equipment is to cost $116,000.

The S. S. Cox Show Case Co., of North Manchester, Ind., will make many improvements to its plant in the near future and will need equipment.

The Davis Carriage Co., Orange, N. J., has been organized to manufacture carriages, by Chas. O. Geyer, F. E. Ruggles and L. Matthews. Capital, $125,000.

The Weatherley (Penn.) Electric Light plant will install new and more powerful machinery to supply power and heat to the Lehigh Valley R.R. shops.

The H. W. Johns-Manville Co., of New York, has purchased a 200-acre site at Finderne, N. J., and will spend about $2,000,000 establishing a plant there.

The Taylor & Boggis Foundry Co. has taken out a permit to erect a power house, pattern shop and office building at 3051 East Fifty-fifth St., Cleveland, O.

The Daleville (Ind.) Canning Co. has been incorporated, with a capital of $5000, by J. G. Sutton, F. M. Boyer and E. M. McDowell, to do a canning business.

The Star Distillery Co., Cincinnati, has been incorporated, with $1,000,000 capital, to do a distilling business, by Simon Hirsch, Max Hirsch, George Wallenstein, etc.

The Keller Knitting Co., Cleveland, Ohio, has been incorporated to make knit goods. Capital, $25,000. Incorporators, Wm. A. Keller, F. C. Keller, J. Iglauer, etc.

Permit has been granted Geo. A. Streitman & Sons Co., manufacturing baker, for a six-story addition to its plant at Twelfth and Canal Sts., Cincinnati, Ohio.

The Rex Manufacturing Co., Jersey City, N. J., has been incorporated to manufacture boxes. Capital, $125,000. Incorporators, R. G. Butler, R. I. Outwater, Geo. L. Record.

The M. R. Short Lumber Co., of Cincinnati, Ohio, has been incorporated, to do a general lumber business, and will need woodworking equipment. Melvin R. Short, incorporator.

The plant of the Pulaski (N. Y.) Electric Light & Power Co. will be overhauled by its new owners and new machinery installed. Frederick D. Corey, of Buffalo, is president.

The Bayless Son's Co., Muncie, Ind., has been incorporated, with a capital of $10,000, by F. B. and W. E. Bayless and Louis Peck, to manufacture inks and other chemical products.

It is reported that the Brunswick-Balke-Collender Co., manufacturing billiard tables, bowling and hotel supplies, will remove its plant from Long Island City, N. Y., to Chicago, Ill.

The Metal Flanged Concrete Pipe Co., Mt. Gilead, Ohio, has been incorporated to manufacture and sell cement products by T. D. Mateer, E. S. Masters, Joseph Hickson, etc. Capital, $15,000.

The Sanitary Earthenware Specialty Co., of Trenton, N. J., has purchased a plant in Columbus, Ohio, and will equip same for the manufacture of its line of lavatories and like products.

The Board of Control, of Cleveland, Ohio, has rejected all proposals and will readvertise for bids for the West Side water-works tunnel and for the high-pressure fire-station equipment.

At Barberton, Ohio, the factory of the Carraca Paint Co. has been purchased by Adam Duncan, and will be turned into a rubber-reclaiming plant. Six reclaiming machines will be installed.

The Sanitary Window Refrigerator Co., Cleveland, Ohio, has been organized with $14,000 capital to manufacture and sell patented refrigerators by C. H. Knight, J. H. Goss, Thomas Lear, etc.

The H. I. Isbell Co., of Elkhart, Ind., has been incorporated to do a general lumber business and will need woodworking equipment. E. E. Isbell, C. R. Isbell and E. C. Godfrey are incorporators.

The Andrews Ice Manufacturing Co., Lebanon, Ohio, has been organized to manufacture ice and do a cold-storage business. Frank Andrews, Charles E. Monroe, Frank Brandon, etc. Capital, $22,500.

The Iceless Refrigeration Co., Cleveland, Ohio, has been incorporated to equip factory and make family refrigerators with small domestic ice-making plants. A. Y. Gowen and others, incorporators.

The Pioneer Pole & Shaft Co., Piqua, Ohio, has been incorporated with $3,000,000 capital to manufacture and deal in all kinds of vehicle poles and shafts by H. D. Hartley, W. A. Snyder, F. L. Marshall, etc.

The Auburn (N. Y.) Silk Manufacturing Co. has been organized to manufacture silk, etc. Capital, $30,000. Incorporators, R. S. Kidney, Auburn; N. Horace Gillette and Harold R. Gillette, Cortland.

The Keokuk Electric Co., Keokuk, Ill., has been incorporated, with $650,000 capital, to operate railroads and produce and operate electricity, by Geo. Higin-

son, Jr., Joseph L. Valintine, Robt. H. Van Deusen.

The Champion Carbon Co., of Cincinnati, Ohio, has been incorporated, to manufacture electric-light carbons and other carbon products, and will need necessary equipment. Andrew Morrison, incorporator.

The Buckeye Light & Power Co., Covington, Ohio, has been incorporated, to build and operate an electric-power plant for light and power, by J. H. Marlin, Hugh C. Marlin, A. W. Landis, etc. Capital, $40,000.

The Kenney Corset Co., of Cleveland, Ohio, has been incorporated, to manufacture corsets, and will need corset-making machinery. C. W. Kenney, J. W. Hagar and R. M. Ewing are among the incorporators.

The Moran Peoples Telephone Co., of Moran, Ind., has been incorporated to erect and operate telephone lines in Moran and vicinity. Will need necessary equipment. H. G. Hurless, O. Z. White, etc., incorporators.

The Weaver-Naylor Co., of Buffalo, N. Y., has been incorporated, with a capital of $20,000, to manufacture roofing. Directors, Robert G. Weaver and Edna P. Weaver, of Buffalo, and William C. Naylor, of Chicago.

The Thorne Automatic Display Cabinet Co., of Cincinnati, Ohio, has been incorporated, to manufacture automatic display cabinets, and will need metal and woodworking equipment. Walter S. Thorne, incorporator.

The Electric Rubber Reclaiming Co., Akron, Ohio, has been incorporated to engage in the business of reclaiming vulcanized rubber. Incorporators, John C. Frank, Geo. H. Ellis, Frank E. Ream, etc. Capital, $200,000.

S. B. & B. W. Fleischer, Inc., Philadelphia, Penn., contemplate the erection of a new mill to be the largest woolen and worsted spinning plant in the world. All the company's interests will be concentrated under one roof.

The Townsman Publishing Co., of Cleveland, Ohio, has been incorporated, to do a general printing and publishing business, and will need printing equipment. W. G. Osborne, H. D. Banks, Anthony Rodgers, incorporators.

The Acme Ivory Button Co., Newark, N. J., has been incorporated to manufacture ivory, bone and pearl buttons. Capital, $10,000. Incorporators, Wm. J. Haggerty, Conrad Leick, Jr., and S. Leick, all of 112 Arlington St., Newark.

Henry L. Doherty & Co., of New York, have purchased an electric-light plant of Isadore Newman, of New Orleans, located at Galveston, Tex., and will make extensive improvements. Frank W. Frueauff, vice-president of the company, is in Galveston.

SOUTHERN STATES

The Paris (Tenn.) Coal & Ice Co. will erect a plant for the manufacture of ice.

Manchester, Ga., voted to issue bonds for the erection of a municipal electric-light plant.

The Jones-Chambliss Co., Jacksonville, Fla., is arranging to erect a new refrigerating plant.

Meadors, Vaughn & Halloran, Nashville, Tenn., will build a $40,000 addition to their ice plant.

The Patchett Worsted Co., Keyser, W. Va., is erecting an addition to be used for the manufacture of woolen goods.

A company has been organized at Jackson, Miss., to build a railroad between Gulfport, Miss., and Covington, La., connecting with the Illinois Central at the latter point. The new company is capitalized at $500,000, and will be known as the Gulfport & Western R.R. Co.

WEST OF THE MISSISSIPPI

The M. R. Smith Shingle Co. will build a large mill at Moclips, Wash.

Wm. Penrod's knitting factory, at Foley, Minn., was destroyed by fire.

Tecumseh, Neb., will issue $22,500 bonds for improvements to its water system.

The Kansas City (Mo.) Billiard Table Co. has secured a permit for the erection of a power house.

The Schwan Fruit Packing Co., Pomona, Calif., will build an addition to its fruit-packing plant.

The Port Heiden (Wash.) Packing Co. proposes to erect a large salmon-packing plant in the spring.

The Aldridge (Tex.) Lumber Co. is erecting a new $400,000 mill, to replace the one burned some time ago.

The Southern Pacific Railroad Co. has taken out a permit to build an addition to its fruit-packing plant at Pomona, Calif.

Wm. G. Bronson, Jr., of Stillwater, Minn., and R. C. Wright, of St. Paul, will erect a cold-storage plant at Stillwater, Minn.

The Fergus Falls (Minn.) Woolen Mill Co. will erect a new factory to cost $20,000.

The city of Ilo, Idaho, is having plans prepared for a water-works system. Modern pumping machinery will be installed.

The Edmund Peycke Co., Pomona, Calif., will build an addition to its fruit-packing plant. New equipment will be installed.

The Mokelumne River Logging Co., San Andreas, Calif., contemplates the erection of a sawmill plant near Jackson, Calif.

The plant of the McKenzie Broom Co., Bryant St., San Francisco, Calif., was totally destroyed by fire. The plant will be rebuilt.

The Union Ice Co., Boca, Calif., plans for the erection of an electric power plant. It is estimated that the plant will cost $500,000.

The plant of the Knutson Sawmill Works, Kalispell, Mont., was destroyed by fire. The erection of a new plant is contemplated.

The Anchor Laundry Co., South Los Angeles St., Los Angeles, Calif., will make improvements and additions in its laundry plant.

The Benson Lumber Co., San Diego, Calif., has taken out a permit to erect a shop-building addition to its lumber-working plant.

The Pacific Telephone & Telegraph Co., San Francisco, Calif., contemplates the erection of a new exchange plant, at Porterville, Calif.

The Port Heiden Packing Co. will erect a new salmon cannery at Port Heiden, Ore. The plant will have a capacity of 40,000 cases.

Borello Brothers, Fresno, Calif., have taken out a permit to erect a modern bottling-works plant on G St. The plant will be fully equipped.

The Keystone-Dot Investment Co., Raton, N. M., contemplates the erection of a large creamery plant. J. D. Waters is head of the company.

The Hercules Sandstone Co., Tenino, Wash., is planning to double the capacity of its stone quarry No. 2. Modern machinery will be installed.

Reynolds & Elliott, Miles, Wash., will make improvements in its sawmill plant. The plant will be fully equipped. Joseph Ingalls is manager.

The City Council, San Diego, Calif., contemplates the erection of a municipal plant for the manufacture of vitrified sewer pipe for city work.

L. F. Cochran, Wichita, Kan., contemplates the erection of a plant at Madera, Calif., for the manufacture of condensed milk and similar products.

The city of Corona, Calif., has voted bonds for the establishment of a municipal rock-quarry plant. About $3500 will be expended upon equipment.

The city of Centralia, Wash., has voted bonds for $100,000 for the installation of a modern water-works plant. C. D. Atterbury, city engineer, is preparing plans.

The city of Bellingham, Wash., plans for the erection of a municipal electric-lighting plant. About $6000 will be expended. City engineer Whitney is in charge.

The Sperry Flour Co., Stockton, Calif., plans to increase the capacity of its flour-milling plant. New equipment will be installed, including a modern conveying system. About $60,000 will be expended.

The sawmill plant of the Grand Ronde Lumber Co., La Grande, Ore., was destroyed by fire with a loss of about $50,000. The planing mill was also damaged. George Stoddard is head of the company.

The Sierra Electric Power Co., Oakland, Calif., recently incorporated, plans for the erection of a hydro-electric power plant at Mill Creek, near Manton, Calif. Charles Gross, Oaland, is at the head or the company.

The Bakersfield (Calif.) Water Co., recently organized, has acquired the plant of the Sumner Water Co., at East Bakersfield. The new owners will increase the capacity of the plant and install new electric pumping machinery.

J. T. Barker and C. L. Nye, Riverside, Calif., have acquired property near the foot of Mount Grayback, Beaumont, Calif., and plan for the erection of a hydro-electric power plant. A distributing system will also be constructed.

The Phillips Printing Co., Los Angeles, Calif., whose printing plant was recently partly destroyed by fire, has leased property at East Fourth and Wall Sts., and will establish a large printing plant. Modern equipment will be installed.

The Home Telephone Co., Los Angeles, Calif., will make extensive improvements and additions, and increase the capacity of its exchange plant at Pasadena, Calif. New equipment will be installed. About $25,000 will be expended.

The Pacific Gas & Electric Co., San Francisco, Calif., will build a new electric substation at Dixon, Calif. The company also plans to make extensive improvements and additions in its gas

plant and systems at Chico and Santa Rosa, Calif.

The Washington Steel & Iron Co., Spokane, Wash., plans for the erection of a 5000-horsepower hydro-electric power plant, near Leavenworth, Wash. Surveys for a dam are now being made. A power-distributing system will also be constructed.

In connection with its proposed improvements and additions to the waterworks, at Springfield, Ore., the Oregon Power Co., Eugene, Ore., will install new pumping machinery. Other improvements are contemplated. About $15,000 will be expended.

Roy W. Comegys, Duvall, Wash., is planning the erection of an electric-lighting plant, near Duvall. A large pumping station will be established in connection with power-transmission and distributing system. A franchise for the work has been granted.

The Pacific Ice Rink Co., Los Angeles, Calif., recently incorporated by C. H. Paffenbach, W. Meredith and Edgar Sharp, with a capital of $100,000, plans for the immediate erection of an artificial ice-skating rink and refrigerating plant at Luna Park, Washington St., Los Angeles.

The West Coast Gas, Light & Fuel Co., Somerset, Calif., recently incorporated, with a capital stock of $75,000, plans for the erection of a gas plant at Artesia, Calif., with a distributing system to Norwalk, Downey and other territory. W. J. McGimpsey is president of the company.

A modern refrigerating system will be installed in the new building to be erected by the Valley Country Club, Ramona Acres, near Alhambra, Calif. Boiler equipment will also be required. Architect J. Martyn Haenke, Central Building, Los Angeles, Cal., is preparing plans.

The city water department of San Diego, Calif., will build a new pumping plant addition to its water-works system, at Point Loma. The pumping station in the University Heights district, San Diego, will also be improved and augmented. A new repair shop will be erected.

The board of education, Los Angeles, Calif., plans for the erection of a school in the Boyle Heights district. A shop building will be erected in connection to comprise woodworking, forge, mechanical drawing and similar departments. Superintendent of schools, J. H. Francis, is in charge.

The Yolo Water & Power Co., Oakland, Calif., has been incorporated by Leon M. Gove, H. L. Breed, M. S. Hamilton and J. E. Bowes, of Oakland, with a capital stock of $10,000,000. The company plans for the erection of a power plant in the Coast Range Mountains, in Yolo County, Calif.

Wilson Brothers, Astoria, Ore., have acquired property on Smith's Point, near Astoria, and plan for the erection of a modern shipbuilding plant. The plant will be equipped to handle large and small boats, both for building and repairing. A woodworking plant will be operated in connection.

The woodworking plant of the Pacific Portable Construction Co., Alameda St., Los Angeles, Calif., was destroyed by fire, with a loss estimated at $25,000. The company, operated by Barker & Butte, manufactures portable houses and bungalows, and plans for the immediate rebuilding of the plant.

The Sacramento (Calif.) Water Co., recently incorporated, with a capital of $1,000,000, has acquired water properties at Salmon Falls, near Folsom, Calif., and plans for the installation of a modern water-works and pumping system. Francis V. Keesling and Ernest L. Brune are at the head of the company.

The Rogue River Pottery Co., Medford, Ore., recently incorporated, has acquired the plant of the Ray Brick Co., at Tolo, near Medford. The company will increase the capacity of the plant and install machinery for the manufacture of brick and pottery of all kinds. J. H. Nickol, Portland, Ore., is at the head of the company.

The Fellows Boat Works, San Diego, Calif., recently incorporated, will soon commence the erection of a boat-building and repair plant on Hawthorne St. The plant will be equipped to construct motor boats, launches, yachts, etc. Emil Aarup is general manager. Joseph Fellows, Wilmington (Los Angeles), Calif., is head of the company.

The Oro Electric Corporation, San Francisco, Calif., recently incorporated as a subsidiary of the Oro Water, Light & Power Co., with a capital of $10,000,000, and headquarters at San Francisco, has appropriated the sum of $7,000,000 for the erection of a large hydro-electric power plant on Yellow Creek, near Belden, Calif. The plant will have a capacity of 60,000 hp. F. V. Pering and F. S. McAllister are at the head of the new company.

CANADA

Clinton, Ont., will equip a new hydro-electric station.

Harrison, Ont., will equip a new water-works system.

The Butwell Brick Co. will equip a new plant at Toronto.

Dunnville, Ont., will install a complete new water-works system.

J. Reid & Sons will equip a large new furniture factory at Calgary.

The E. W. Gillette Co. will equip a new power house, at Toronto.

Pacfitt Bros. will equip a new sash and door factory at Victoria, B. C.

The McLelan Lumber Co. will equip a big new plant at Ladner, B. C.

The Canada Post Publishing Co. will equip a new plant at Vancouver.

The Pontiac (R. I.) Glove Co. is to install new machinery in its plant.

The Canadian Hair Cloth Co. will locate a plant at St. Catherines, Ont.

The Dominion Mahogany & Veneer Co. will locate a new plant at Montreal.

The Riverdale Lumber Co. will build a large new box factory at Calgary.

Grandview, Manitoba, will purchase additional electric-lighting equipment.

The Commercial Box & Envelope Co. will equip a new plant at Kingston, Ont.

The Winnipeg Electric Water Heating Co. will equip a new factory at Winnipeg.

The Fraser Lake Water & Power Co. will equip a new plant, near Victoria, B. C.

Stratford, Ont., will purchase a new water-works pump, motor and water meters.

The Parry Sound Wood & Turning Co. will equip a new factory at Parry Sound, Ontario.

The Dominion Mahogany & Veneer Co. will build a new $75,000 plant at Lachine, Quebec.

The National Brewery Co. will equip a new bottling factory with the latest machinery.

The St. Stephen Fertilizer Co. will equip a new 10,000-ton plant at St. Stephen, N. B.

Vancouver, B. C., will equip a new municipal rock-crushing plant and will expend $40,000.

The Nokomis Oil & Gas Co., of Paris, Ont., will equip a plant to develop light, heat and power.

The British Canadian Canners Co., of Montreal, will expend $500,000 on new plants in Ontario.

Winnipeg is calling for tenders for a million-gallon motor-driven vertical centrifugal pump.

The Magog Power Co. will equip a $125,000 hydro-electric plant on the Magog River, at Magog, Que.

The F. C. Burroughs Furniture Co. will build a new furniture factory at Queen and Bathurst Sts., Toronto.

Glickman & Glickman will purchase power machinery for a big new addition to their factory at Montreal.

The Dominion Canners, of Hamilton, have appropriated $500,000 for equipping new plants as soon as possible.

The O'Keefe Brewing Co. will build a new $100,000 addition to its Toronto plant and install new machinery.

Fire damaged machinery in Roden Brothers' cut glass factory, at Toronto. Loss, $20,000. Will be replaced at once.

The Grand Trunk Pacific Co. will expend $500,000 on a new elevator, at Fort William. Electrical machinery required.

The J. A. Thody refrigerating plant, at Aylmer, Ont., was completely destroyed by fire. It will be rebuilt and enlarged.

The Canadian Puget Sound Lumber Co., Victoria, B. C., plans for the erection of a sash- and door-manufacturing plant.

M. A. Devitt and H. W. McCoy, of Chicago, will equip a new $1,000,000 power plant on the Bull River, near Fernie, B. C.

The big Bloomfield Mills, at Fergus, Ont., were completely destroyed by fire. Will be rebuilt. Owners, Canadian Cereal Co.

The London & North Western Radial Ry. Co. will build a new power plant at Rock Glen. D. A. Stewart, London manager.

Fire caused a loss of $200,000 in the D. S. Perrin biscuit factory at London, Ont. A new $250,000 plant, to be equipped with the latest machinery, will be erected as soon as possible.

MINING

The Larson Lode Mine, near Metaline, Stevens County, Wash., is considering the installation of a concentrator.

The Combination Mine is considering the installation of electric drills on the property, near Cottage Grove, Lane County, Ore.

The Midas Mine, at Randolph Flat, Grass Valley district, Calif., is to be reopened and a five-stamp mill installed by Joseph W. Young, of Sacramento.

The North Washington Power & Reduction Co. is considering enlarging the

capacity of its new mill and cyanide plant, at Republic, Ferry County, Wash.

The Inspiration Consolidated Copper Co. has filed a certificate of incorporation in Maine with $30,000,000 capital, and will take over the Live Oak and Inspiration properties, in Gila County, Ariz. It is reported the new company will soon commence construction of a concentrating mill of about 10,000 tons capacity per day.

Business Items

The S. K. F. Ball Bearing Co., 50 Church St., New York, has opened an office, at 1505 Heisen Building, Chicago, to facilitate the handling of Western business. C. A. Winn, manager.

The L. S. Starrett Co., Athol, Mass., at a meeting of the stockholders, Dec. 20, voted to increase its capital stock to $3,500,000, of which $1,500,000 is to be 6 per cent. cumulative preferred stock and $2,000,000 common stock. The officers of the company elected were: L. S. Starrett, president; F. A. Ball, vice-president; F. E. Wing, treasurer and secretary, and W. G. Nims, assistant treasurer. Directors, the four officers named, and M. B. Waterman, Augustus P. Loring, John A. MacGregor, J. H. Drury and W. B. McSkimmon. The last four named are officers of the Union Twist Drill Co., also of Athol. The Union Twist Drill Co. becomes a stockholder of the L. S. Starrett Co., and as such has representation on the board of directors, which is increased from five to nine. The L. S. Starrett Co. was incorporated in 1900, with a capital stock of $100,000, since which time its business has increased far out of proportion to the original capital.

Forthcoming Meetings

Society of Automobile Engineers. Annual convention, New York City, Jan. 18-20, 1912. C. F. Clarkson, general manager, 1451 Broadway, New York City.

American Society of Engineer Draftsmen. Regular Meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Hotel Bellevue. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month, Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Calipers: Welles Caliper Co., Milwaukee, Wis.

Caliper catalog free. E. G. Smith, Columbia, Penn.

Sachs' standardized tool requisitions; mechanical drawings. J. J. Sachs, Lynchburg, Va.

We buy or pay royalty for good patented machine or tool. Box 282, Am. Machinist.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Technical patents a specialty. G. M. Sacerdote, engineering patent attorney, 1919 Broadway, New York.

We build to order light machinery, tools, jigs, subpresses and dies; high-grade work. The Elgin Tool Works, Elgin, Ill.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Patents procured by mechanical engineer and patent expert; new boiler patent for sale. I. Benjamins, 302 Broadway, New York.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Machine work, machine models, patterns, forging gears, pumps and engines built or repaired. Clark Machine Co., St. Johnsville, N. Y.

We build machinery on contract, and would like an opportunity to quote your prices on machines or parts. Sellew Machine Tool Co., Pawtucket, R. I.

High-grade machine work in quantities for gear cutters, hand turrets, milling machines, etc., wanted. The Seneca Falls Mfg. Co., Seneca Falls, N. Y

Tool tempering chart. 13½x1½ inches, printed in colors with full description; 10 cents postpaid. Spon & Chamberlain, 123 Liberty St., New York, publishers.

For rent—Moving into new plant, will rent present adjoining factory with large modern brass foundry; cheap electric power; 15,000 square feet; rent low. Rushmore Dynamo Works, Plainfield, N. J.

Simple, meritorious inventions bring profits, often fortunes; mail description of your invention for free, candid opinion and estimate to apply for patent. E. P. Thompson, M.E., Victor Bldg., Washington, D. C.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan, is wanting good agencies for machine tools of all kinds. Box 189, Am. Machinist.

Australian business, advertiser, financial partner in Australian engineering works sailing for England and America about March, 1912, seeks commissions from American houses desiring Australian representatives; collect information before leaving Australia, visit American house and arrange agency or carry out other instructions on return. Particulars. Address "Australian," Am. Mach.

Help Wanted

Classification indicates present address of advertiser, nothing else.

Delaware

ASSISTANT CHIEF DRAFTSMAN—Large industrial corporation; applicants should have technical education and at least five years' drafting-room experience, and must have experience in handling men; experience in design of special and automatic machinery is essential, and, in addition, experience in one or more of the following branches: Powerhouse design, mill and factory construction, structural steel, acid works or other chemical manufacture; only men who can furnish the best of references as to character and ability will be considered. App'y, stating age, experience in full and salary expected, to Box 712, Am. Machinist.

Illinois

FOUR LATHE HANDS, four milling machine hands, two automatic machine operators, four drill press hands, one case-hardening hand, one milling machine hand for tool room, one tool maker; only first-class, experienced men need apply; steady positions; thirty-eight miles from Chicago; standard wages assured, if you can produce results. Box 748, Am. Machinist.

Maryland

DRAFTSMEN OF experience, general heavy machinery details, also first-class rapid machinery tracers. Box 747, Am. Machinist.

STRUCTURAL DRAFTSMAN, familiar with construction of steel barges, as leading man, also detailers. Address, stating experience and salary desired, Box 710, Am. Machinist.

SPOON MAKER—Must be experienced and familiar with uptodate methods of making retinned steel spoons, knives and forks; good opportunity for right man; give references. Address "Expert," Am. Machinist.

Massachusetts

MACHINIST FOREMAN wanted for about 40 men; state age, experience and wages desired. Box 738, Am. Machinist.

SUPERINTENDENT—Energetic man to be superintendent of plant employing 200 men; technical training, experience with production and cost systems preferred. Box 732, Am. Machinist.

Michigan

GUN BARREL MAKER, experienced, capable of taking the material in the rough and producing finished barrels. Box 754, Am. Machinist.

DESIGNER—A thoroughly capable machine designer on medium-size automatic machinery, by corporation located in the Middle West; a permanent position to the right man; correspondence treated in confidence. Box 736, Am. Machinist.

Missouri

TOOL MAKER to take charge of tool room; must understand modern shop practice; state age, salary and references. Box 719, Am. Machinist.

New Jersey

TOOL MAKER, first-class, with inventive ideas and accustomed to small-tool work for iron and brass valves and fittings. Box 758, Am. Machinist.

New York

LATHE HAND on magneto work; must be A-1 man; state experience and salary expected. P. O. Box 290, New York City.

TOOL MAKER, first-class, on medium-size work, jig, dies, etc.; state experience and salary expected. P. O. Box 290, New York City.

DESIGNER—By large eastern manufacturer, to handle line of high-grade gate valves up to largest size; state experience, salary expected, etc. Address "Opportunity," Box 739, Am. Machinist.

BENCH HANDS—Several first-class; also horizontal boring machine and plan-

er hands wanted on machine tool work; permanent positions and good opportunity for advancement; state experience and wages expected. Box 757, Am. Machinist.

PRESS SHOP FOREMAN, to manufacture small and medium size drawn articles from light gage steel; none but experienced and successful men considered; write in confidence, giving full particulars as to experience, age and salary expected. Box 682, Am. Machinist.

FOREMAN, press room, experienced in drawing, piercing, blanking and bending dies and who has had charge of men and can turn out work at right cost; write, giving age, experience and salary expected, and when could begin work; all correspondence confidential. Box 744, Am. Machinist.

TOOL MAKER, capable of taking charge in manufacture of tools for finishing brass and iron body valves; man experienced in this line of work preferred; permanent position for right man; in replying, state age, experience, married or single, if now employed and wages expected. Box 743, Am. Mach.

FOREMAN, to take charge of 25 to 35 men in assembling department, manufacturing machine tools; only first-class mechanic with experience and ability to produce results wanted; unusually good opening with opportunity for advancement based on results; state experience, age and salary expected; applications considered confidential. Box 756, Am. Machinist.

WORKS MANAGER—Old established and well organized company, employing about 1000 men, and manufacturing a high-class product, wishes to secure a capable works manager of large experience in the production of small and accurate mechanisms, such as adding machines, typewriters, firearms, etc.; man under 40 years of age preferred; applicants are requested to give their experience in full; state age, positions occupied, and furnish list of references. To the right man a permanent position is assured at liberal salary; location, New York State. Box 693, Am. Machinist.

Ohio

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Oregon

DIE AND TOOL MAKERS—Nothing but first-class skilled workmen need apply. United States Cashier Co., Kenton, Ore.

Pennsylvania

INSTRUMENT MAKERS, first-class, for our experimental department. Write Westinghouse Electric & Manufacturing Co., employment department, East Pittsburg, Penn.

SALESMAN, by reputable manufacturing concern, reliable person to sell textile machinery; man with technical education and practical experience preferred. Apply to P. O. Box 579, Reading, Penn.

OPERATOR—Bilgram gear generator operator, experienced on cutting automobile bevel drive gears and pinions; only thoroughly competent men need apply; state experience and wages expected. Standard Roller Bearing Company, Philadelphia, Penn.

DESIGNER—Steady job for an experienced man who can design and make molds for composition small insulating parts, such as strain insulators, insulating joints, insulating bases, etc.; a man with all-round experience on hydraulic and other presses preferred; please state, in confidence, experience, age and salary. Box 751, Am. Machinist.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Virginia

FOREMAN, machine shop; man accustomed to manufacture of gas engines and heavy machine tools; applicants should state experience, age and salary expected; all communications treated confidentially. Box 737, Am. Machinist.

Situations Wanted

Classification indicates present address of advertiser, nothing else.

Connecticut

ACCOUNTANT—Able to install and operate a cost or bookkeeping system; best of references furnished. Box 727, Am. Machinist.

Illinois

TOOL DRAFTSMAN AND DESIGNER, experienced on fixtures, jigs, dies, etc., for small interchangeable parts, thoroughly practical, has manufacturing department and toolroom experience, one year assistant foreman in toolroom, seeks position. At present employed. Box 702, Am. Machinist.

Indiana

TOOL MAKER, all-round tool maker and jig builder in the Middle West. Box 753, Am. Machinist.

Kentucky

HAVING DISPOSED of my interest in foundry, machine shop and garage of which I have for past six years been manager, now wish to connect with reputable house; twenty years' experience from office boy up through traveling salesman, buyers, sales manager and manager of wholesale and manufacturing; always connected with machinery and mill supplies. Address "J. W. W." care Am. Machinist.

Michigan

FACTORY ACCOUNTANT—Executive, with ten years' experience in production, stores, time, cost and premium systems. Box 749, Am. Machinist.

GENERAL FOREMAN or master mechanic, also expert tool designer, uptodate methods; expert in devising ways and means of machining parts rapidly and accurately; can furnish A-1 references; have also two A-1 machine tools, will go with services. Box 752, Am. Machinist.

FACTORY SUPERINTENDENT, experienced engineer and mechanical manager; long experience in gasoline and gas engines; for last seven years in charge of development work and factory organization of one of largest gasoline engine makers in United States; my work there now done; can design engines and machines; put any engine factory on economical basis of scientific management; can reorganize automobile factory methods; can develop tractors for farm use; can act as manager for steam engine, pump or air compressor shops; have a record I will be proud to show you; best of recommendations from those I have successfully helped; have designed the best line of gasoline engines on the market today; still under 40; both American and foreign experience; thoroughly practical; can deliver all I claim. Box 740, Am. Machinist.

New Jersey

DESIGNER, experienced on automatic machinery, dies, tools, etc., wants position. Box 483, Am. Machinist.

MECHANICAL DRAFTSMAN and designer; 12 years' shop and drafting experience. Box 726, Am. Machinist.

GENERAL FOREMAN or foreman; 10 years' experience as foreman and master mechanic; good executive; best references. Box 714, Am. Machinist.

SUPERINTENDENT, general foreman, practical, well informed in modern shop methods and management; ten years executive. Box 745, Am. Machinist.

DRAFTSMAN, experienced in checking, machine shop, tool room, instrument and vacuum cleaner work; also interchangeable tools. Box 750, Am. Mach.

FOREMAN, experienced in modern machine shop practice; specialist on tools and methods for reducing costs; tactful with men; first-class references; age 30. "Hustler," Box 734, Am. Machinist.

SUPERINTENDENT—Position as superintendent or manager of machine shop about May 1; at present drawing a salary of $5000 a year; with present firm five years; with last firm ten years; reference if required; would consider a smaller salary along the Pacific coast. Box 708, Am. Machinist.

New York

MECHANIC, 17 years designing and building special machinery; competent to take charge. Box 742, Am. Machinist.

DESIGNING DRAFTSMAN, wide experience special automatic machinery, desires position near New York. Box 730, Am. Machinist.

DRAFTSMAN—Young man, ten years' successful experience, reliable, accurate, inventive ability; A-1 references. Box 637, Am. Machinist.

CHIEF DRAFTSMAN, thoroughly experienced on intricate machinery, experimental work, etc.; can show results. Box 721, Am. Machinist.

DRAFTSMAN, wide practical executive experience with reliable concern, capable of originating special machinery, etc. Box 638, American Machinist.

FOREMAN, practical mechanic, general experience, 10 years executive, machine tools, machinery, jigs, fixtures, etc., desires change. Box 746, Am. Machinist.

COST ACCOUNTANT desires change; thoroughly capable of handling entire cost department; twenty-seven years of age; energetic and reliable. Box 755, Am. Machinist.

GENERAL SUPERINTENDENT, now employed, would consider change; practical machinist; good organizer; familiar with uptodate practice; first-class references. Box 688, Am. Machinist.

Ohio

SALESMAN, experienced with machine tools and general machinery, with executive, commercial and practical ability, open for engagement. Box 709, Am. Machinist.

FOREMAN—Young man employed as foreman for five years on auto parts and general work, cranks and camshafts included; experienced in setting piece and premium rates, would consider change. Box 741, Am. Machinist.

OFFICE MANAGER or chief clerk, thoroughly conversant with modern office and shop methods; twelve years' experience in cost accounting, storekeeping and general office work; five years in executive capacity; best of reference from present and past employer. Box 759, Am. Machinist.

GENERAL MANAGER, thoroughly practical and experienced in the handling of manufacturing plants, consisting of main office and such departments as engineering, machine, foundry, blacksmith, boiler, wood and kindred departments; will take charge on salary or commission, or both, and with highest degree of productive efficiency; guarantee open shop and freedom from labor troubles. Box 687, Am. Machinist.

Pennsylvania

MECHANICAL ENGINEER, with 10 years' practical experience and with inventive and executive ability; first-class designer, capable of developing and designing anything in the mechanical and structural line; would like position as chief engineer or chief draftsman; willing to invest some money with position; A-1 reference. Box 716, Am. Machinist.

For Sale

60x60-in. by 14-ft. William Sellers' worm-driven planer; four heads, with power feeds in all directions; nearly new; bargain to quick buyer. Address "X Y Z," Am. Machinist.

$1500 cash and balance on easy terms to suit at 7% interest buys a completely equipped machine shop and foundry located in a live town of 17,000 in the midst of a section where work can be drawn from nearly every direction; shipping facilities are unsurpassed; splendid railroad service; the property, buildings, lot and equipment could not be duplicated for twice the asking price; an exceptional opportunity to step in and build up a big business. For full particulars, address Box 733, Am. Machinist.

Long established and well known line of woodworking machinery, consisting of planers and matchers, surface planers, jointers, band saws, variety saws, swing saws, wood turners, lathes, etc.; patterns, jigs and good will (also machine shop tools) of this business offered at very reasonable price; splendid opportunity to secure a live business at low cost. Address "Wood Working Machinery," Am. Machinist.

Talks With Our Readers

By The Sales Manager

The AMERICAN MACHINIST editorial staff in 1911 has traveled 65,000 miles and visited 480 shops.

As a result of its efforts, and those of our contributors here and abroad, let's see what we have had, remembering that a page of the AMERICAN MACHINIST equals in size three or four pages of an ordinary textbook.

General articles	868
Letters and discussion	1113
General articles from foreign countries	77
Letters and discussion, foreign countries	169
New tools	425

Increasing shop capacities, 16,537 items.

It is, of course, impossible to tabulate articles under exact headings, or to subdivide them too closely. An article showing, say, how automobiles are built, probably contains milling, planing, gear-cutting as well as excellent toolroom devices. And while it deals directly with automobiles, it suggests ideas which can be adapted to any line of work.

Apprenticeship and industrial education, both in and out of the shop, covers 44 pages.

Automobile-building methods and design of automobile parts, 88 pages.

Machine design, including jigs and fixtures, 94 pages.

Drawing-room practice and hints for draftsmen, 41 pages.

It must also be remembered that everything under the heading of machine design is also of vital interest to the draftsman who desires to get ahead, making a total of 125 pages of material particularly interesting to him.

There has been about an average of one page per issue devoted to general broad Engineering subjects, while 93 pages have been devoted to what may be called Factory engineering. This includes shop construction, methods of driving machinery, lighting, heating and ventilation and all such subjects which come to the attention of the factory engineer.

In the Blacksmith department, which includes forging, welding, hardening and tempering, there have been 45 pages, while of matters pertaining to the Foundry 55 pages have appeared.

General manufacturing methods have occupied 69 pages, with 147 pages devoted to general machine work, 37 pages to especially large machine work, and 72 pages to such small work as typewriters, guns, adding machines and similar products.

Machine-tool building has occupied 73 pages, again disproving the complaint in some quarters that we devote too much space to the machine-tool field.

Pattern work, pure and simple, shows 20 pages, and it must be remembered that practically all of the foundry material is also of interest to pattern makers, which adds 46 pages to this.

Sheet-metal work, which includes punches and dies, averages over a page each week, and forms the most complete information to be obtained in this line.

Railroad-shop material, 43 pages, although here too the railroad-shop man cannot fail to secure many valuable suggestions from the methods shown in the shops doing general machine work.

Factory management, which includes methods of paying workmen, of following work and keeping track of its cost, and what might be called manufacturing, occupies 115 pages.

Tool making averages 87 pages of information, in addition to a large number of suggestions contained in articles which could not be classed as tool-making articles.

And just as important are the advertisements of the progressive manufacturers which have appeared weekly, furnishing a reliable and uptodate market place for you.

The entire volume shows the progress of the machine-making industry during 1911—a mine of invaluable information for anyone interested in making machinery of any kind.

* * *

Only reliable products can be continuously advertised.

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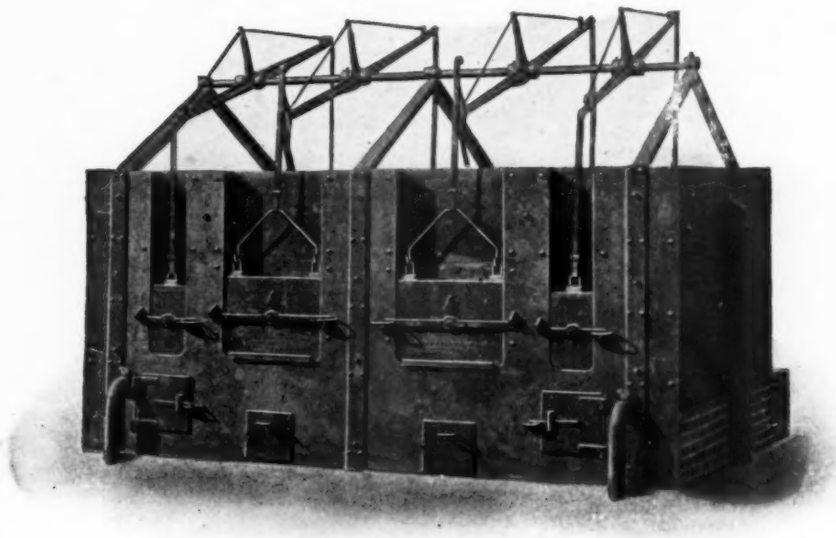

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We have 33 furnaces at work daily.

A circular, giving full particulars, sent on request.

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Grinding Talks

In Thirteen Weekly Chapters

Number Eleven

Definitions Of Abrasives

ALOXITE

The grinding of steel requires an abrasive material that is hard and sharp, but in addition to these characteristics it must be exceedingly tough. The abrasive material to meet these requirements must be what is known as an aluminus abrasive; that is, it must consist principally of fused alumina in its purest possible form.

Aloxite, because of its absolute purity, its hardness, sharpness and toughness, has been extensively successful in all classes of steel grinding. The characteristics of aloxite permit of its being not only fast-cutting and long-lasting, but positively cool-cutting.

ALUNDUM

Alundum is oxide of alumina in crystalline formation. It is made by fusing the mineral Bauxite in the intense heat of the electric furnace by the arc process.

The manufacture of Alundum is under control, which enables the production of this abrasive material in the different combinations of hardness, sharpness and toughness, which the manufacturers speak of as "temper." In other words, it can be made in tempers adapted to different classes of grinding. The average grain of Alundum is transparent, and contains sharp cutting corners.

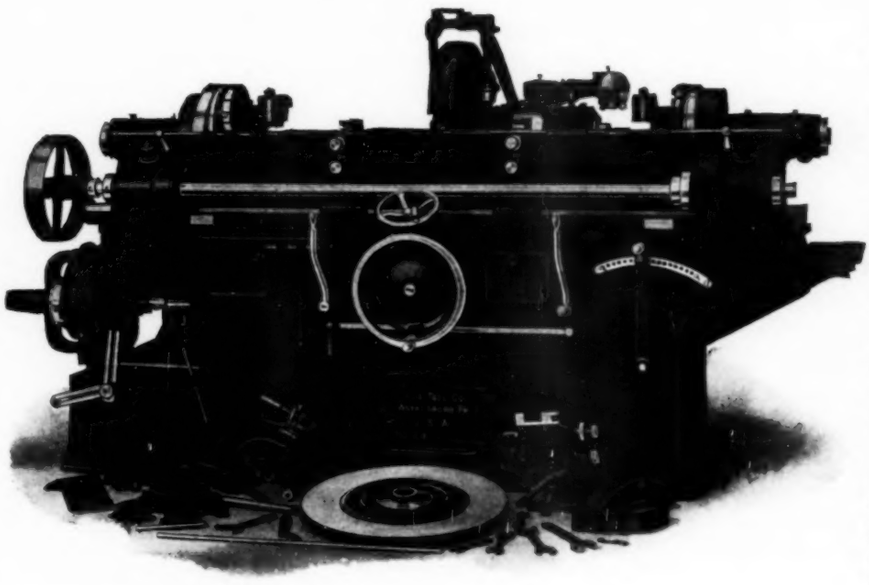
The physical formation of the grain is such that when it is broken or fractured it leaves sharp cutting corners or edges.

CRYSTOLON

Crystolon is carbide of silicon in crystalline formation. It is an electric-furnace product made from coke, sand, sawdust and salt. The characteristic property of brittleness makes it highly efficient for polishing and grinding such metals as cast iron, chilled iron and brass; in fact, all materials possessing low tensile strength. It is claimed for carbide of silicon that with the exception of the diamond it is the hardest material in the world.

Next Week—"Grinding Wheel Grains"

Engine Manufacturers



An indispensable machine for Automobile Builders, Launch and Engine Manufacturers.

It not only furnishes the most rapid method for grinding crank shafts, but assures the absolute accuracy in pins and line bearings so essential for work of this character. The Landis Crank Grinding Machine has capacity for single and multiple crankshafts with throws up to 8″ single and 6″ multiple. It has adjustable heads for holding and carrying work, a special grinding wheel truing fixture for rounding corners of the wheel for grinding the fillets, and other improved features which put it in the lead for Crank Shaft Grinding.

For grinding the pins the work is driven from both ends and is carried by special fixtures mounted on the face plates which are adjustable for the different throws and have both English and metric scales.

LANDIS TOOL CO. Waynesboro, Pa.

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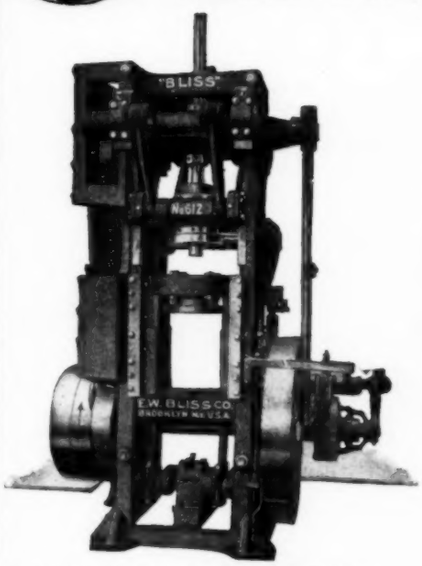

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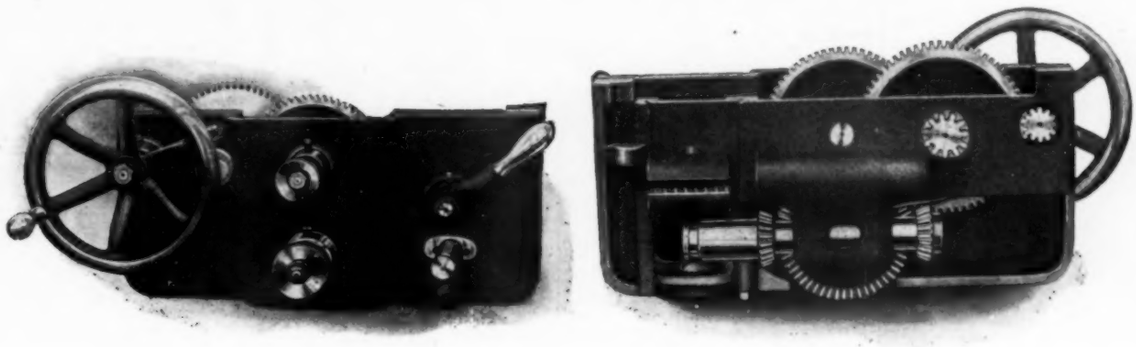

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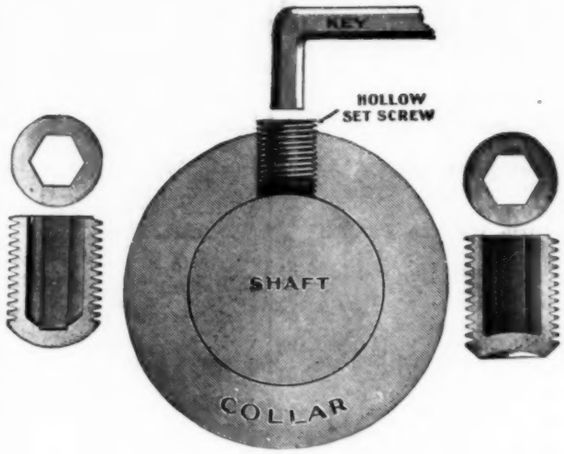
ORIGINAL HOLLOW SET SCREWS



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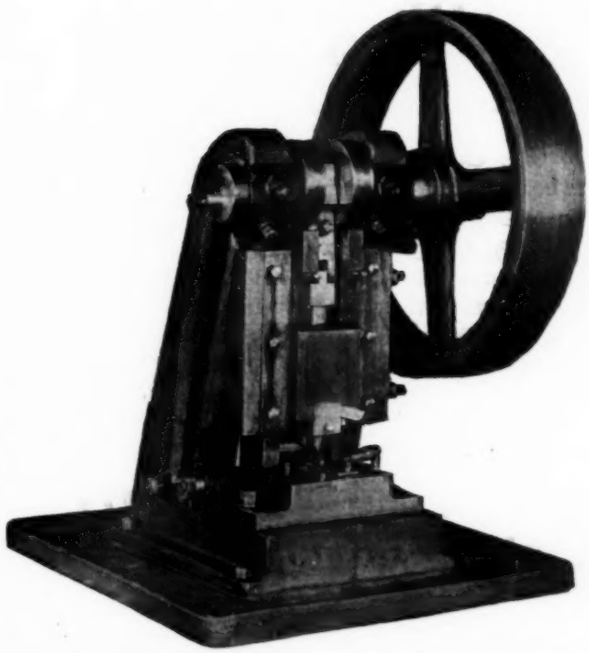

It is a remarkably rapid producer of such work, which it handles with utmost accuracy and convenience.

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YOU can't make it otherwise. The Classified Index in the *American Machinist* might well be defined as the shortest route between the buyer and the advertising pages of this paper. Those who want immediate information regarding anything in the Selling Section of the *American Machinist* turn to the Classified Index, knowing that there they will find an accurate key to everything mentioned in the advertising pages. This index eliminates all roundabout methods of arriving at any desired information regarding "who's who, and who makes it." It leads you straight to the point—in a bee line.

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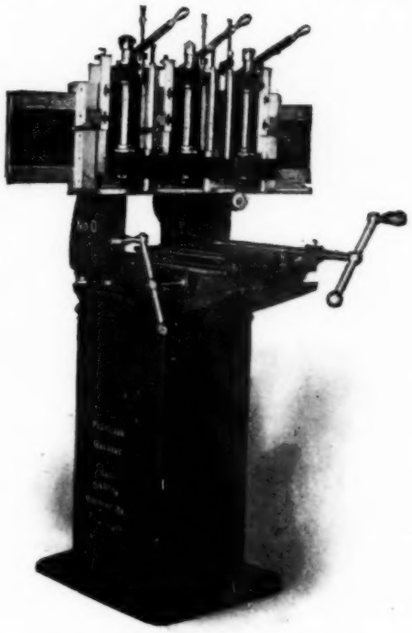

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They are designed for high speed, are of rugged and simple construction—Belt or Wesson Drive.

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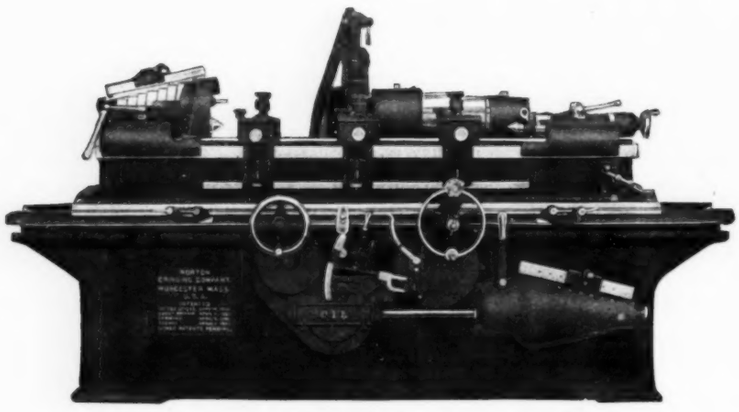
Spring and Varick Sts., 45 Years in New York City

Breaking Away From Tradition In Grinding

And Finally Here We Offer You Some Examples Showing It Pays

This Is Talk No. 4—And Last



14″ x 50″ Machine

This is the last of a series of talks urging the *proper* use of grinding machines—the use of methods that pay best. Briefly stated the object of these talks is to show manufacurers that it pays to eliminate the finishing cut in the lathe. To put the work on the grinding machine directly after a rough cut in the lathe.

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If you require a grinding wheel for general machine shop use or for steel castings, steel dies, drop forgings, knives, lathe and planer tools, milling cutters, reamers, taps, twist drills, etc., the first wheel you should try is a Norton Alundum Wheel.

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TRADE MARK REGISTERED
Crystolon
TRADE MARK REGISTERED

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Niles Tool Works, Heavy Pattern, Double Column, with floor space 16 ft. x 8 ft., practically new.
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(1) ft. Fosdick
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(1) 4 ft. Box, half universal
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(1) 48x48x16 Detrick & Harvey, open side, one rail, one side head
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(2) Inclinable
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(1) 12 in. Curtis Pipe Machine
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9x44 Star, plain rest
14x 5 Hendey, C. R., quick change
15x 6 Flather, C. R., P. C. F.
15x 6 Putnam, C. R., P. F. C.
16x 6 McMahon, C. R., P. C. F.
18x 6 Lodge & Davis, C. R., P. C. F.
18x 8 Lodge & Shipley.
20x 8 McMahon, compound rest, chuck
20x 8 Fay & Scott, compound rest, P. C. F.
20x10 Draper, C. R., P. C. F.
24x14 Reed, high speed.
27x12 Pratt & Whitney, C. R., P. C. F.
28x10 Draper, C. R., P. C. F., taper
30x12 Niles, C. R., P. C. F.
32x12 Johnson, triple geared, C. R.
32x17 Bement-Miles, C. R., triple geared
32x10 Draper, C. R., P. C. F. taper
36x14 and 16 Lodge & Shipley, C.R., P.C.F.
38x14 Pond, Pl. R., P. C. F.
40x18 Newark, triple geared, C. R., P. C. F.
46x28 Fitchburg, compound rest, P. C. F.
102x35 Bement, compound rest, P. C. F.
21x14 Powell, compound rest, P. C. F.
60x26 Fifield, C. R., P. C. F.
84x20 Putnam, C. R., T. G.

SCREW MACHINES

20x8 Bogart, turret on carriage
2¾" Pearson, F. B. G., P. F.
1x10 Pratt & Whitney, wire feed with tools
24" American, heavy turret
2x24 Jones & Lamson, flat turret
20x6 Bardons & Oliver, F. B. G.
No. 2 ⅞" Warner & Swasey, wire feed
No. 2½ Garvin, wire feed, friction head
No. 1 Garvin, wire feed
⅜" National Acme, automatic
No. 6 Brown & Sharpe, friction head
1" Smurr & Kamen, wire feed
½", ¾", 1", and 2⅜" Pratt & Whitney automatics
No. 3 2" Pratt & Whitney, wire feed
No. 2 ⅝" Pratt & Whitney, wire feed
No. 1 7/16" Pratt & Whitney, wire feed
No. 6A Potter & Johnston, automatic
1¼" 4-spindle Gridley, automatic
2¼" 1-spindle Gridley, automatic
1½"x18" Pratt & Whitney

MILLERS

No. 4½ Becker, small plain
No. 2 Le Blond, plain back gears
No. 2 Pratt & Whitney, Lincoln pattern
No. 24 Brainerd, plain back gears
No. 1 Cincinnati, universal
No. 2 Brown & Sharpe, plain
No. 3 Cincinnati, plain
No. 12 Brown & Sharpe, manufacturers'

DRILLS

26" Lodge & Davis, B. G. & P. F.
28" Barnes, B. G. and P. F.
30" Mueller, plain radial
32" Box, half universal, radial
No. 25 Foote-Burt, high speed
F 12" Baker Bros.
30" Gang, plain radial
5' Baush, plain radial
10-Spindle Gardam, multiple
7-Spindle Slate, bedstead drill
20" Prentice Bros., wheel and lever feed
4-Spindle Foote-Burt, adjustable rail

PLANERS

20x20x4 Pease, 1 head
26x26x6 Pond, 2 heads
36x36x8 Gleason, 1 head
36x36x7 Sellers, 1 head
36x36x12 Betts, 4 heads
74x56x20 Pond, 2 heads
48x48x15 Pond, 3 heads
48x42x8 Farrell, 1 head
30x30x8 Davis & Egan, 2 heads

SHAPERS

12" Prentiss, horizontal crank
16" Cincinnati, crank, B. G.
13" Lodge & Davis, crank
15", 20" and 24" Hendey, friction
30" Gould & Eberhardt, crank
17" Juengst, horizontal crank

MISCELLANEOUS

Bending Rolls, 8'x10"
Boring Mill, 37" Bullard, 2 heads
Boring Mill, 10' Pond
Boring Mill, 2¾" bar, Bement
Boring Mill, 48" Colburn
Centering Machine, 1 sp., Hendey
Gear Cutter, 22"x4', Gould & Eberhardt
Gear Cutter, 72" Gould & Eberhardt
Grinder, Walker, electric surface
Grinder, No. 2 Bath universal
Gas Engine, 8 H. P., Fairbanks
Hammer, 50 lbs., Bradley compact
Hammer, 200 lbs., American, Steam
Hammer, 1600 lbs., Pratt & Whitney, drop
Keyseater No. 2, Giant
Slotter, 16" Bement, motor driven
Slotter, 12" Betts
Grinder, Sellers universal tool
Welding Outfit, Sanford
Press, No. 68 Bliss, double acting
Grinder No. 23, Landis, plain
Bolt Cutter, 1½" Merriman
Furnace, No. 38 American, Gas
No. 2 Lapointe broaching machine
Saw No. 5, Cochrane & Bly

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42" Diamond small roll
Valley City Wet Tool
Cincinnati Pl., Cutter & Reamer
Pratt & Whitney Cutter Grinder
Rod Grinder, 11" swing
Style-A Yankee Drill Grinder
Heald Wet Twist Drill Grinder
No. 1 Cincinnati, Univ. Cutter and Reamer
36" Diamond, small roll
Gisholt Water Tool
Hisey-Wolf, Type-A, Electric
No. 2 Allen, Bench, emery
26" Huntington, suspended
No. 60 Heald, Cylinder
No. 24 Landis, crank
No. 1-J Besly Spiral Disc

POLISHING LATHES

No. 2 Norton, Dble. End on col.
No. 1 Zucker, Dble. End, Bench
No. 5 Zucker, Dble. End on col.
No. 2 Diamond Buffing
No. C Diamond Belt Strapping Attachment
No. 4 Vulcan, Dble. End on col.
No. 7-C Diamond Polishing
No. 3 Diamond Dble. End
No. 3 Hanson & Van W. on column
No. 1 Belt Strapping Attachment

TAPPING MACHINES

No. 4 St. Louis Tapper
Brown & Sharpe, Hor. Tapper
Specialty Horiz. Tapper
¾" Woodward & R. Horiz.
Ferry, Single Spin. Auto. Nut
No. 1 Garvin, Horiz.
Ohio Hand Nut Tapper
No. 1 Errrington Tapping Attachment

EXHAUSTERS AND VENTILATORS

No. 35 "ABC" Steel Plate
No. 3 Buffalo Cast Iron.
50" Sturtevant Steel Plate
No. 35 Sturtevant Shavings
60" Buffalo, steel plate
60" Fuller Disc Fan
No. 25 Type-E Steel Plate
No. 2 "ABC" Cast Iron
32" Sturtevant, Double
70" Sturtevant, Steel Plate
96" "ABC" Fan
40" Disc Fan

KEYSEATERS

No. 1 Davis, Cap. ⅜ to 1"
No. 0 Mitts & Merrill, 7" Stroke

COLD SAWS

No. 1½ Paragon, high duty
Angle Power Hack Saw
6" Stroke, Quincy Hacksaw
Cochrane-Bly, cap. 4¼"
No. 2 Sterling Hacksaw
7" Stroke, West Haven Hacksaw

PRESSES

No. 18 Holden O. B. I.
2" stroke Michigan, O. B. I.
No. 2 Stiles & Parker, open side
No. 31 Toledo, ¾" stroke
No. 56 Toledo St. Side, with outside trimming attach.
Springfield Straightening
D-G-74 Ferracute St. Side
No. S-24 Ferracute, non-geared
No. 20 Bliss O. B. I.
No. P-4 Ferracute, non-geared
No. 53 Fowler Fly Wheel
D-G-55 Ferracute Drawing
No. 5 Plain, Stiles solid bk.
No. 7 Perkins Model I, st. side
No. 45 Perkins Model E.
No. P-5 Ferracute Fly Wheel
No. 4½-P Michigan O. B. I.

PUNCHES AND SHEARS

Thompson Boiler Plater Bevel Shear
1¾"-stroke Gd. Wheel Rim Punch
9" Alligator Shear
No. 205 Niagara Gd. Power Circle
Blacksmith's Punch, 1" stroke
30" Squaring Shear

MILLING MACHINES

No. 4 LeBlond Plain, all feeds with vertical attachment
Pratt & Whitney, bk. geared
No. 59 Bement & D. Plain
No. 1 Cincinnati Plain
Oesterlein back geared plain
No. 2 Carter & Hakes, Lincoln
No. 2½ LeBlond, plain
No. 1 Beaman & Smith, duplex
No. 5 Brainard
Beaman & Smith, 2 spdle. motor driven
Pratt & Whitney Hand
No. 0 Farwell Quick Change
No. 2 Davis & Egan, back geared
No. 1 LeBlond Plain
No. 2 Fox Hand Miller

MISCELLANEOUS

Countershaft, 100 different styles and sizes
Chucks, Lathe and Drill, all sizes
Rivet Spinner, No. 80 Grant
Gear Cutter, No. 11 Dwight-S
Furnace, No. 6 Stewart, case hard
Gas Furnace for heating irons
Separator, Noble, Magnetic
Brake, 8' Ohl Automatic.

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A modern drop forging shop equipped with hammers, both steam and drop from 1000 to 10,000 pounds. Bull dozers, Ajax upsetter, Heat treating furnaces, etc.

This plant was completed last year and was built especially for making 1 beam automobile axles, crank shafts, truck axles, and is said to be the best equipped plant in the world for that purpose.

If you are interested it will pay you to investigate.

Trade to the amount of $50,000 per annum goes with the plant.

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Slightly Used Machines In Stock
For Immediate Delivery

P65 Ferracute punching press.
30 in. Gould & Eberhardt gear cutter.
800 lb. Bement Miles & Co. single frame steam hammer.
2 No. 14 Garvin Hexagon Turret Lathes, 3¼ in. hole in spin. swings over gap 30 in.
2 No. 5 Springfield Oscillating Surface Grinders, Planer type, 23 in. betweenhousings.
o. 2½ Pratt & Whitney milling machine, table is 11 in. x 6 ft.
22 in. x 18 ft. Harrington Lathe.
30 in. x 30 in. x 8 ft. Pease Planer
22 in. x 22 in. x 6 ft. P well Planer.
No. 5 Bliss Horizontal Reducing Press, weighs 4,000 lbs.
36 in. x 12 ft. Heavy Duty Slab Miller.
2— in 2 Van Norman Duplex Milling Mach co.
28 in. Barnes Drill.
48 in. Gang Radial Drill.
26 in. Gould & Eberhardt Shaper.
Q. & C. Cold Saw, capacity 6 in. round 10 in. I Beams.
No. 4 Brown & Sharpe 48 in. Gear cutter.
48 in. x 20 ft. Triple Geared Lathe, blocked to 56 in.
No. 2-A Owen Full Universal Milling Machine, with vertical spindle attachment.
16 in. x 8 ft. Bradford Quick Change Gear Lathe.
14 in. x 8 ft. American Gap Lathe.
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75 lb. Dienelt & Eisenhardt Belt Hammer.
20 in. x 10 ft. Harrington Lathe, with taper attachment.
Mitts & Merrill Keyseater.
No. 2 Cincinnati Universal Milling Machine, with vertical attachment.
2 in. Acme Bolt Cutter.

Large stock of all machines necessary for the equipment of modern machine and boiler shops. Send for latest list.

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BOLT CUTTERS

1" National, double head
1—¼" National, single head
1—¾" Acme, double head

BORING MILLS

3" Gisholt vertical turret mills, swings 34"
32" Baush Vertical Turret Mill
No. 4 Betts Horizontal Boring Machine, 3" bar, 6' table

DRILLS

20" Rockford three spindle gang drill
21" Hoefer, wheel and lever, back gears, power feed
22" Swing Snyder Sliding head, back gears, power feed
26" Barnes, sliding head, tapping
28" Hamilton Sliding Head, tapping
32" Hamilton, sliding head, excellent condition
36" Bickford Radial
No. 3 (6') Bickford Full Universal Radial, cone drive
No. 22 Moline 4 sp. multiple, cap. four 2" holes in steel

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No. 1 Brown & Sharpe Universal
No. 4 Gardner Disc Grinder, with discs and press
Barnes water grinder with 24" wheel
No. 7 Ransom dry grinder, capacity for 30" wheels

HAMMERS

800-lb Ferris & Miles Steam Hammer
1500-lb Lane steam drop, all steel frame

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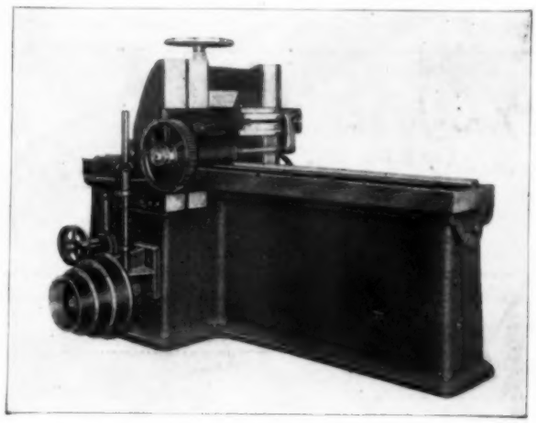
12"x 5' Davis
14"x 6' Lodge & Shipley, 3 step cone, double back gears
14"x 6' Prentice, compound rest, four step cone
15"x 6' Von Wyck, compound rest
16"x 8' Flather, compound rest
17"x 8' Greaves & Klusman, comp. rest, turret on shears
21"x 8' Le Blond, three step cone, double back gears
21"x10' Fitchburg, compound rest
43"x18' Wood & Light, compound rest, raised to 48"
Fitchburg Lo-Swing Lathe

TURRET LATHES AND SCREW MACHINES

Brown & Sharpe turret lathe, ⅝" capacity
No. 2 Warner & Swasey Turret Lathe
24"x10' Walcott Turret Lathe, power feed turret with 1 13/16" holes
25" Gisholt Heavy Turret Lathe
28" Pond Rigid Turret Lathe
No. 55 National-Acme Auto. Screw Machine, cap. 1⅝"
⅞" Cleveland Automatic

MILLING MACHINES

SAMPLE OF OUR SECOND HAND MACHINES



15"x8' KEYSTONE SLAB MILLER
15" BETWEEN HOUSINGS, 8' TABLE

No. 0½ Brown & Sharpe Universal with dividing head
No. 15 Becker-Brainerd Universal
No. 3 Kempsmith Plain, geared feed, all power feeds
No. 3 Cincinnati plain, cone type, all power feed
No. 24 Brown & Sharpe plain, disc feed, table 72"x14"
No. 5 Ingersoll Combination Vertical and Horizontal, with three inserted tooth milling cutters

PLANERS

20"x20"x 4' Pease, with Farwell milling head
22"x22"x 5' Whitcomb
36"x36"x10' Whitcomb, two heads

MISCELLANEOUS

Farwell Gear Hobber
16" Ohio Crank Shaper, 17" stroke
No. 11½ Higley Cold Saw.
National 1½" Six Spindle Nut Tapper
No. 1 Stiles Punch Press
No. 2 Baker Bros. Key Seater
10" Putnam Slotter, with circular table
20" Baker Bros. Draw Stroke Slotter

Send for our "Red Cross List," giving prices and full descriptions.

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Lincoln - Williams High Speed Taper Bridge Reamers

are fast working tools of long, efficient life. They are made of the same high quality high speed steel as the well known L-W High Speed Twist Drills. Write for catalog and prices.

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Landis Bolt Cutters With Landis Dies

are far in advance of all other machines for the purpose. The dies outlast all others 10 times over and cut more accurate, uniform threads. Head is made entirely of steel and same chasers cut right or left hand threads. Ask for all the features. Bulletin?

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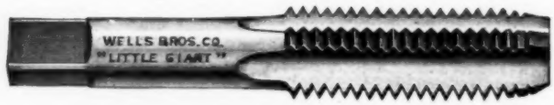

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locate worth. Try our taps on your meanest job and keep a record of them.

We shall be prepared for your further orders.

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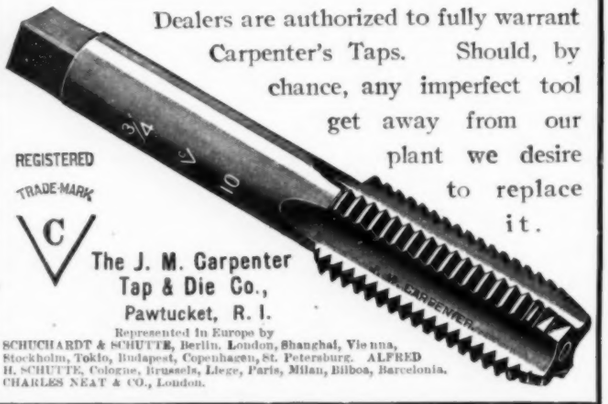

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Bay State Taps Are Sure

Sure to satisfy because they're made right.
They're tested for clean, fast cutting qualities.
They're sure to give satisfaction.
They're tested from end to end.
Every Bay State Tap or Die is warranted.
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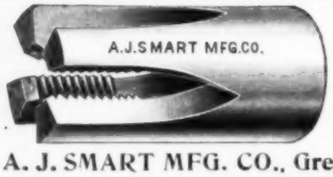

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MADE OF

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If you aren't using them now it is because you never have. You can do more work and get better results with this drill than with the ordinary combined center drill and it surely is worth your while to investigate them.

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will make you sure of best results *always*. Ask for catalog describing our Taps, Dies, Screw Plates, Reamers, etc.

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There's No Danger

If you use Wallace Patent Self-Opening Dies there's no danger of injuring either die or thread in backing off after thread is cut.

This one fact alone should induce you to try them.

Another advantage lies in the fact that threads can be cut flush up to a shoulder. As the shank of the die is hollow, any length of threads may be cut which the travel of the turret slide will allow.

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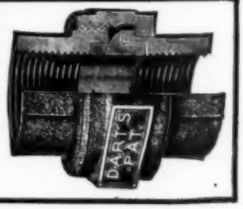

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We guarantee our Taps and Dies as to both quality and efficiency.

Sure to satisfy you.

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You'll need more drills when you stock up for the New Year.

When ordering keep in mind

"Detroit" Twist Drills

and their guarantee, which means satisfaction or your money refunded.

Keep in mind also that the only right basis for judging "Detroit" Drills is by the work they do. Let them prove their work value to you by a good stiff test. May we send you Catalogue "A"? It's arranged for ready reference.

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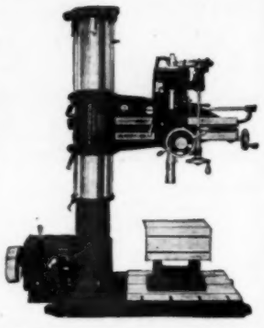

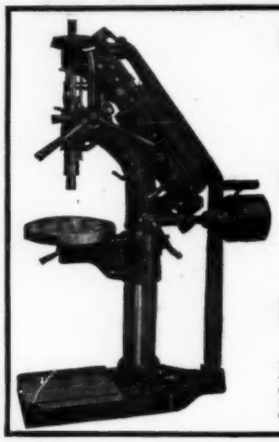

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My Brother is Twenty-Four

You should also see him work. We both are *All Geared* and hold championships for *Strength*, *Power*, *Speeds* and *Feeds*.

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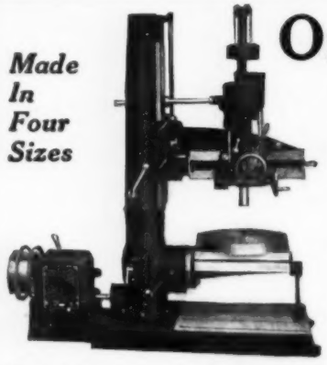

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Controls All The Spindle Motions Of The New

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This highly productive drill is invaluable for modern manufacturing.

Let us tell you all its features.

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is for ¾ inch to 3 inch shaft, which it cuts at maximum speed and with perfect accuracy. Spindle is heavy and strongly geared 3 to 1; cutters are driven at uniform rate of 40 R. P. M., feed can be stopped automatically at any point, and there are many other features you should know. **Ask for Catalog M.**

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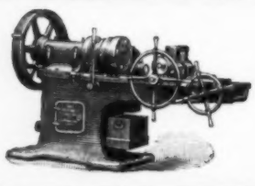
Confidential Designers and Contractors for Special Machinery



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Single and Multiple Spindle Drills
Reliance Bolt Cutters

Cleveland, Ohio, U. S. A.

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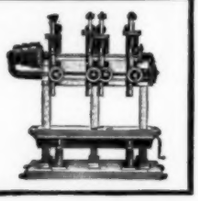

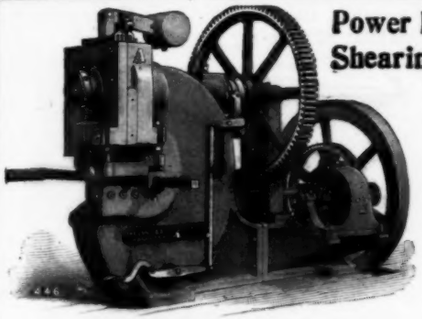

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For Light or Heavy Work.

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A light easily-handled pipe threading and cutting machine—THE FORBES. Requires only one man to thread or cut pipe up to 15". It's a strong, simply constructed long lasting machine, that can be *taken to the job*, saving its cost quickly in saving of time and labor.

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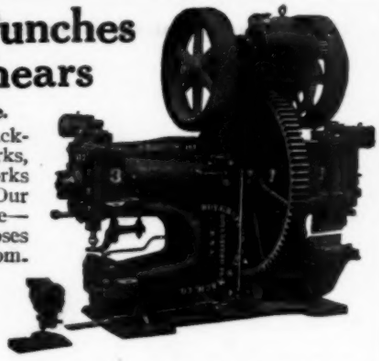

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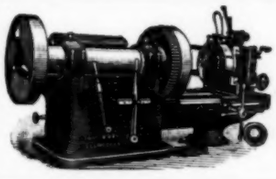

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We not only know how, but we have every equipment—Automatic Machines, tools, that must result in better machinery for you, at a reasonable cost.

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Correct size of test block broken by a ¾" Allen Safety Set Screw, with wrench two feet long. Estimated pressure on point of screw, seven tons. The screw showed no indication of having been used.

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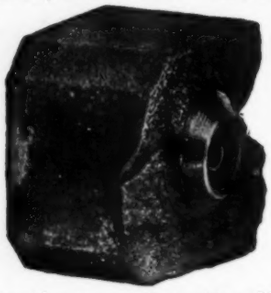

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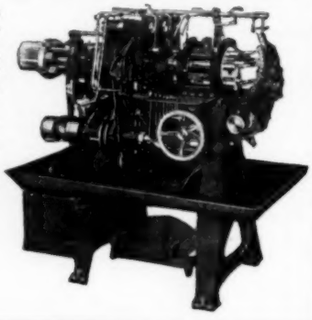
enables the operator with one set of cams to do a wide variety of work; a range of 50% of the travel of the tool. Special cams, costly and causing delay, are not needed on the "Davenport" (except for special work), yet all the advantages of special cams are obtained with none of their troubles.



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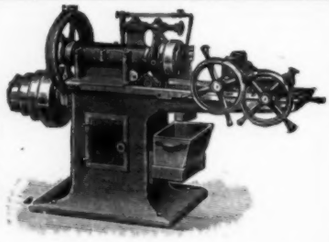

are fitted with the well-known Acme die head, which has a special adjustment for adjusting the dies to size without stopping the machine. The dies are all made interchangeable with the steel caps; dies changed from one size to another in less than one minute. Acme Die Heads are all lined with tool steel hardened and ground to size. Write for Catalog "M."

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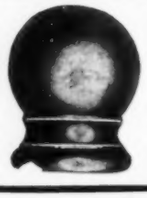

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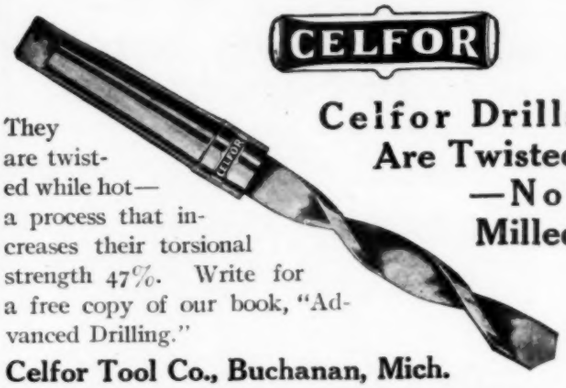

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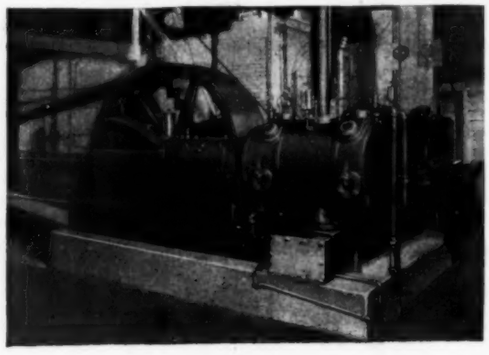

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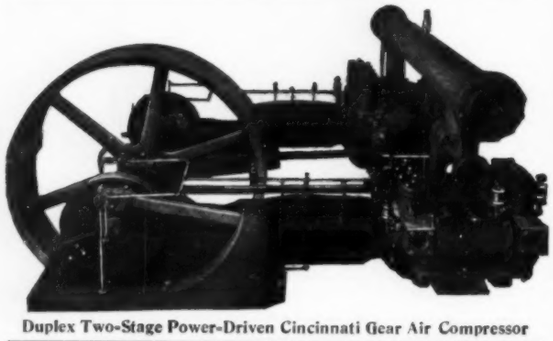

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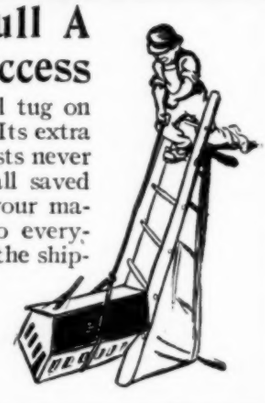

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With or Without Stand

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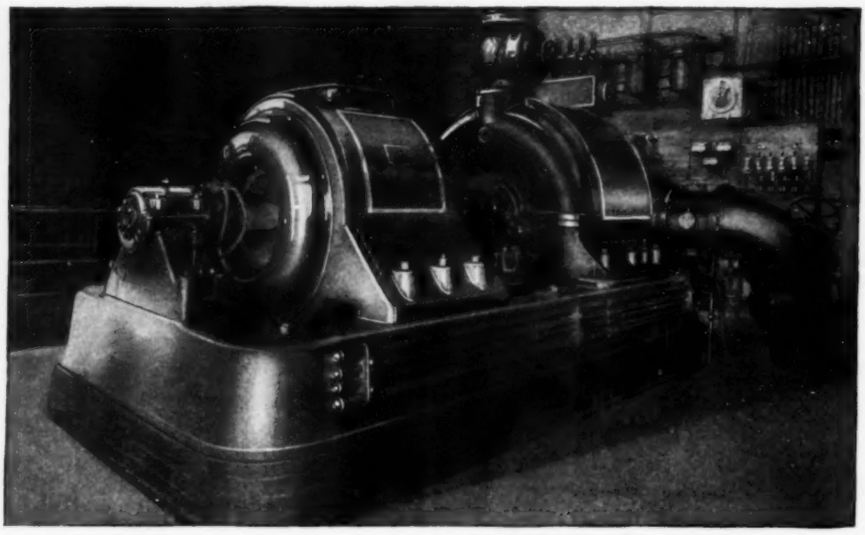

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The Indiana Steel & Wire Company installed a 600 kw. mixed pressure Curtis Turbine to run on the exhaust steam from two 22 x 42″ Corliss non-condensing engines, and when engines are not running, on live steam at 100 pounds' pressure.

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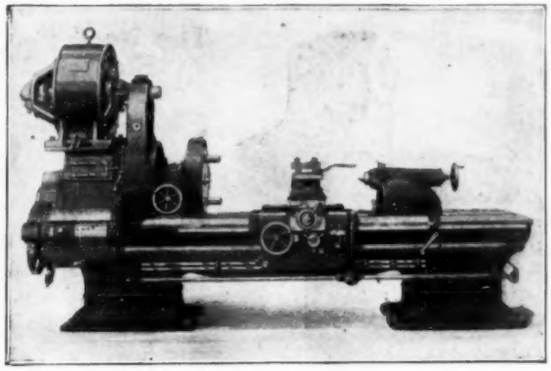

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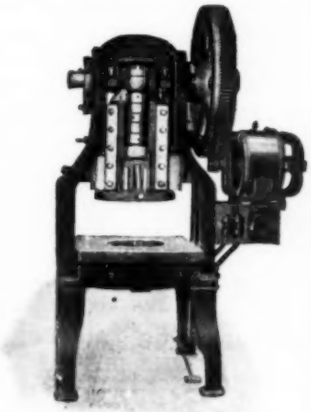

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Efficient and Uninterrupted Service

SIMPLE
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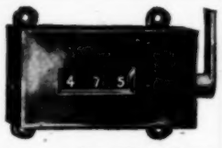

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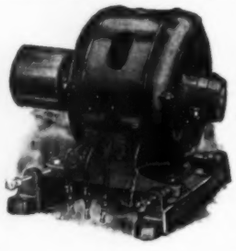

is the most important single characteristic for your motors, for when the motor stops, the profits stop, and expense begins.

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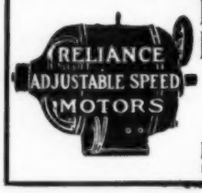

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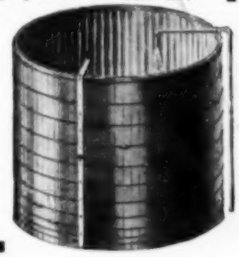

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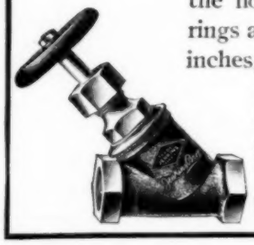

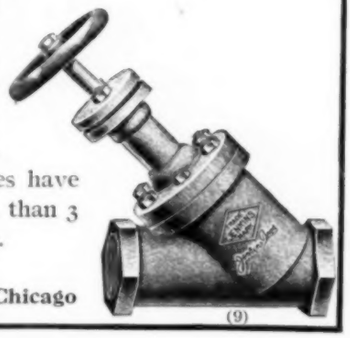

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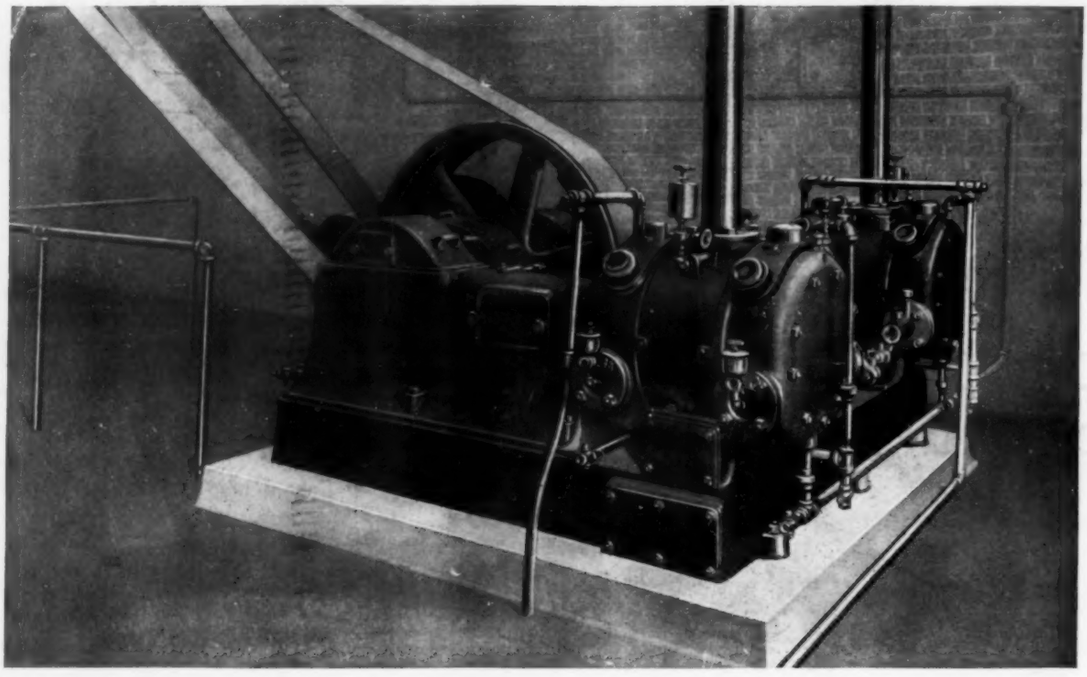

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